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The Plusiinae (Lepidoptera: Noctuidae) of America North of Mexico, Emphasizing Genitalic and Larval Morphology

Technical Bulletin No. 1567

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The Plusiinae (Lepidoptera: Noctuidae) of America North of Mexico, Emphasizing Genitalic and Larval Morphology

By THOMAS D. EICHLIN and HUGH B. CUNNINGHAM

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ABSTRACT

T. D. Eichlin and H. B. Cunningham. The Plusiinae (Lepidoptera: Noctuidae) of America North of Mexico, Emphasizing Genitalic and Larval Morphology. U.S. Department of Agriculture Technical Bulletin 1567, 122 pp., 1978.

Adults of 71 species and larvae of 35 species of the noctuid subfamily Plusiinae of America north of Mexico were studied. Included are keys to the genera based on adult structures, a key to the species for which larvae are known, with setal maps and illustrations of other taxonomic characters, and keys to the adults based on the external morphology and on the male and female genitalia, with photographs and illustrations of the structures.

Two species are described, *Syngrapha abstrusa* n. sp. and *S. cryptica* n. sp., which form a species complex with *S. alias* (Ottolengui). *S. viridisigma* (Grote) is elevated to species level, having previously been considered a variation of *S. selecta* (Walker). *Caloplusia* Smith and *Anagrapha* McDunnough are synonymized with *Syngrapha* Hübner. Biological data, distributional information, and bibliographical notations are included. A phylogeny for the species comprising the subfamily in North America is proposed. This phylogeny has been deduced by correlating characters of both adults and larvae and comparing it with similar studies of Palearctic species.

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The Plusiinae (Lepidoptera: Noctuidae) of America North of Mexico, Emphasizing Genitalic and Larval Morphology

By THOMAS D. EICHLIN and HUGH B. CUNNINGHAM¹

INTRODUCTION

The noctuid subfamily Plusiinae is distributed throughout the tropical, temperate, and arctic regions of the world. The North American fauna includes representatives of each of these climatic regions. This paper treats the North American fauna, but the need to integrate our fauna with that of other faunal regions is great.

Certain plusiines are frequently mentioned in the literature because their larval forms (loopers) are leaf feeders, which damage economically important crops, garden vegetables, greenhouse plants, and ornamental herbs. The boreal species cause some injury to conifers (Prentice, 1962).² The remainder of the species

are leaf feeders on a great array of plants. Larvae of species in the genus *Chrysaspidia* Hübner feed on various species of grasses.

This revision recognizes 71 species and places them in 17 genera. We have endeavored to demonstrate the relationships among the species as interpreted from our data. Based on larval studies, the species are closely related, except for the *Abrostola* group. The species are grouped according to their deduced phylogenetic relationships based on the adult and larval characters of the extant species. Our classification is explained under "Phylogeny."

This publication includes data and keys to the late-instar larvae of 35 species.

TAXONOMY

The early catalogers Walker (1857, 1858) and Smith (1893) included the majority of Plusiinae species in the genus *Plusia* Ochsenheimer; Walker applied the name Plusidae for the group. Hampson (1913) placed most of the species in two genera, *Phytometra* Haworth and *Syngrapha* Hübner, and included all plusiines in the subfamily Phytometrinae.

The North American classification of the

subfamily is based for the most part on the revision by McDunnough (1944). His checklist (1938) was based on Dyar's generic designations (1902). The arrangement of McDunnough's list was based largely on genitalic characters and on the work of Richards (1932) on skeletal morphology of the noctuid tympanum. Interpretations of the tympanal studies are discussed later in the present paper, since they pertain to phylogenetic associations of the subfamilies of the Noctuidae. McDunnough and his contemporaries were among the first to fully recognize the value of genitalic structures in taxonomic treatments. McDunnough (1944) used these structures as the primary basis for his classification and the delineation of species in the genus *Syngrapha*. The principal short-

¹ Systematic entomologist, Division of Plant Industry, California Department of Food and Agriculture, Sacramento, Calif., and systematic entomologist, Department of Zoology-Entomology, Auburn University, Auburn, Ala., respectively.

² The year in italic after the author's name refers to Literature Cited, p. 59.

coming of his revision was his failure to describe adequately the remaining species in the subfamily.

Forbes (1954) placed the majority of the species in the genus *Plusia*, retaining the generic categories employed by McDunnough as subgenera.

Crumb (1956), in his work on the noctuid larvae, included 24 species in 9 genera of *Plusiinae*. Based on larval characters, he combined some of the genera as applied by McDunnough but did not specify any synonymy. For example, Crumb treats *Trichoplusia* McDunnough, *Argyrogramma* Hübner, and *Pseudoplusia* McD. in the same sense but does not indicate that the genera should be synonymized with *Argyrogramma*. Some of his diagnostic characters have been shown to be too variable for identification.

Brown and McGuffin (1942), Forbes (1954), McGuffin (1954), Ross and Evans (1957), and Wood and Neilson (1960) described the larvae of certain species or made short keys to the larval forms of small groups of species. Their descriptions in many cases apply equally well to larvae of other species, due to a reliance on color patterns. The use of color pattern for identification is not possible from preserved specimens, which lose the normal color and become a uniform cream color. In nature, the pattern is usually a pale-green ground color with various longitudinal white or yellow striping.

Unfortunately, Saunders (1863) and Nordman (1942) used color exclusively in their descriptions of the larvae.

Gardner (1947), utilizing many morphological features, wrote on the larval stages of certain Palearctic species, none of which are included in the Nearctic fauna.

Kostrowicki (1961), in his extensive study of the adult Palearctic *Plusiinae*, derived a classification along the lines of McDunnough's North American revision. In the former's paper, he suggests some changes, which are discussed later in the appropriate categories, and divides the genera into zoogeographical groups. Group A includes those genera that are characteristically tropical and subtropical in distribution and only poorly represented in the Holarctic fauna, occurring there only in the southern por-

tions. From the Nearctic, he includes in this group *Argyrogramma*, *Trichoplusia*, and *Chrysodeixis*. Group B, with one exception, is characteristically Nearctic-Neotropical, and in our fauna he includes *Autoplusia* and *Rachiplusia*. Group C is exclusively Holarctic, but for one species in the Alpine Zone of the Andes Mountains. This group includes *Caloplusia* and *Syngrapha*. Group D is for all other genera, which are mostly Holarctic and particularly in the Palearctic Region.

In studies much like this current undertaking, Ichinose (1962 and 1973) revised the Japanese *Plusiinae*. His classification is the result of an integrated approach, using adult and larval morphology. His work with the immatures, as was the case with Crumb (1956), led him to adopt a somewhat more conservative system than those studies based mainly on adult genitalia.

Recently, another *plusiine* fauna was detailed by Dufay (1970). Working with the Madagascar species, he pointed out disagreements he had with some of Kostrowicki's and Ichinose's conclusions, mainly on the generic level. Dufay defends his system on the basis that structures of the genitalia, particularly on the males, and the form of sternite 8 of males are the best set of characters upon which to determine the most correct natural relationships.

The classification that follows evolved from the integration of information obtained from the study of larvae and adults. The classification is not as conservative a system as Ichinose's and not as liberally divided up as McDunnough, Kostrowicki, or Dufay have viewed the subfamily. The phylogeny derived from this study of the Nearctic has been compared with those arrived at by Kostrowicki (1961) and Ichinose (1962) for the Palearctic regions. A study of the Pantropical *Plusiinae* is essential to get the total worldwide phylogenetic picture of the subfamily. The authors hope that studies such as this one and those mentioned above will stimulate others to take up the challenge of clarifying the *Plusiinae* of the Tropics, and with the use of larval characters as well as adult characters, set up a classification that reflects the subfamily worldwide.

BIOLOGY

The information that follows is based on specimens reared in the laboratory. Average development time from egg to adult was 30 days. The species collected in the Southeastern United States required only 3 days from deposition of the egg to time of hatching. The duration of this developmental stage was about 8 days for species taken in the Northern United States and Canada. Most species pass through five instars with each stage requiring 3 to 5 days. *Pseudoplusia includens* has six larval instars.

The prepupal stage lasts from 1 to 2 days. The adults emerge about 8 days following pupation and usually mate the second day following emergence. It was not uncommon to find 10 to 12 spermatophores in the corpus bursae. These numbers indicate that in nature, multiple matings are the rule, not the exception.

The adults are active, strong fliers and feed on nectar from flowers. The females produce a sex pheromone, which attracts males to the vicinity, but apparently the chemical is not specific (Berger, 1968). When close to the females, the males apparently rely on visual and other stimuli to locate the females.

Intricate behavioral rituals and possibly mechanical structures supposedly constitute isolating factors. The male emits a highly volatile chemical for a short time when in close proximity to the female. This chemical is dispersed from minute droplets on long hair pencils located in a pocket on the venter of the abdomen. The hairs project caudad and are ventral to the vinculum of the male genitalia. When the pocket is everted, the hairs spread forming a wide fan. This permits the maximum surface area to be exposed, enabling the volatile chemical to be dispersed very rapidly into the air. The pheromone probably serves either to tranquilize or excite the female until copulation has been accomplished. The pheromone may also serve as a recognition device, letting the female "know" that the proper male of the same species has arrived (Birch, 1970).

Light traps used for attracting moths are probably inefficient, at least for species of the subfamily Plusiinae, particularly as a means for evaluating population densities or for recapture

of marked and released specimens. Moths were observed at night feeding on flowers of *Cephalanthus occidentalis* L. (button bush) not more than 15 feet from a black light trap. At least half of the flowers had moths feeding on them at a given time, yet only two moths came to the light during the entire evening, which represented a small percentage of the moths in the area. The effectiveness of the traps depends upon many variables, such as the species of moth, temperature, humidity, wind, intensity of the light, stages of the moon, and probably others. One of the most productive evenings for collecting at a black light was during a steady rain, which is probably contrary to popular belief.

Some of the species of plusiines flew, fed, and oviposited during daylight. *Trichoplusia ni* and *Pseudoplusia includens* were observed to be active in large numbers in fields of cotton and soybeans in the afternoon in Alabama. *Syngrapha microgamma* was observed actively moving about in open bogs in northern Michigan in bright sunlight as early as 11:00 a.m. Specimens of *Syngrapha u-aureum* were most readily taken from the flowers of a small species of *Solidago* during daylight above the tree line on Mount Washington, N.H. This diurnal activity is the characteristic behavior of many of the species, particularly of those in the high altitudes and northern latitudes.

The females deposit ova singly on the larval host plant, placing them far apart, in most cases on different parts of one or more plants during the same ovipositing session. One female usually deposits 200 to 300 eggs during her lifetime.

The species of *Abrostola* overwinter in the pupal stage. The remainder of the plusiines, so far as is known, overwinter as early instar larvae, probably third instar. Larvae reared from females of species that are northern in distribution would stop feeding in the laboratory after reaching the third instar. Some moulting was observed later but without increase in size. Attempts to interrupt this diapause in the laboratory were unsuccessful. Fortunately, a few specimens in each culture continued to develop.

SYSTEMATIC TREATMENT

The subfamily Plusiinae is worldwide in distribution. The species are quite uniform in general appearance and morphology except for species of *Abrostola* Ochsenheimer and *Mouralia* Walker. Paraphrasing Forbes (1954), the Plusiinae have a prominent head, strong tongue, and large ocelli. Labial palpi are well developed with segment 3 long; eyes are naked and heavily lashed. The tympanum is the usual for noctuids, but with tympanic membrane deep in, not easily visible without dissection, and the wing venation is quadrid. Male genitalia lack corona for the most part, at least for those species in the limited fauna under discussion. Most species are stout bodied, with deep vestiture and strong thoracic and abdominal tufting; palpi are upturned; antennae are simple with very short, fine cilia in most species; a membranous lobe like a second hood is present behind the tympanic hood; and tympanic pocket 4 is much enlarged, producing a large swelling on the outside of the body.

The larvae of all species, other than *Abrostola* and *Mouralia*, have only three pairs of fully

developed prolegs, one on each of segments 5, 6, and 10. The caterpillars loop as they move, due to the reduced number of abdominal prolegs. The crochets are arranged on the prolegs in a longitudinal, biordinal series, except for the uniordinal arrangement on *Chrysaspidia* species. A small, corrugated sclerite on the hypopharynx, the raduloid, is characteristic of most plusiines but has been observed on a few nonplusiine species in closely related groups.

The pupae, according to Nakamura (1974), insofar as the Japanese fauna is concerned at least, can be distinguished from other noctuid subfamilies by the abnormally high position of the labrum, as in most Pyraustinae pupae, and by the rounded projection mesally extending on the abdominal segments, formed by the apex of the wings and maxillae, a condition common to some Cucullinae.

We divide the subfamily into three tribes, Abrostolini, n. tribe; Argyrogrammini, n. tribe; and Autographini, n. tribe; on the basis of adult and larval characters.

Methods and Materials

The adults utilized in this study were either borrowed from museums and private collections, reared, captured at light traps, or caught by aerial net day or night. Moths were also taken while feeding on flowers by day or by using a headlamp to see them on flowers at night (Nielsen, personal correspondence).

Eggs for rearing were obtained from gravid females. When the eggs hatched, one or two first-instar larvae were placed in a 1-oz plastic cup, containing 15 ml of an artificial medium developed by Shorey (1965). Larvae of each instar and the pupae and the adults were killed and preserved for further study. Immatures were killed by dropping them in gently boiling water for 1 to 3 minutes, depending on their size. The water was allowed to cool before the larvae were transferred into vials containing 70 percent ethyl alcohol for preservation. Adults were killed and pinned.

In Alabama and Florida, some plusiine speci-

mens were collected by beating vegetation and examining host plants. These methods produced no larvae in Michigan, New York, New Hampshire, Maine, and Quebec, the northern regions where collecting was done.

Reared larvae associated with adults were scarce in collections. Except for a few species, preserved plusiine adults were well represented in the larger collections in the United States and Canada.

Selected specimens were sent to the British Museum for comparison with type material. Type specimens as well as series of specimens were examined at the National Museum of Natural History, Washington, D.C., and the American Museum of Natural History, New York. Identifications of adults were made primarily by comparing genitalic preparations with descriptions, keys, and illustrations by McDunnough (1944) and Forbes (1954). Many of

these original identifications were later verified by comparing them with type material.

The genitalia of males and females of all species were removed, cleared, and preserved either in glycerine in plastic microvials or mounted in balsam on slides.

Distribution and host plant data were compiled from several literature sources, included Forbes (1954), Crumb (1956), Prentice (1962), and Tietz (1972), and personal correspondence. Other data were taken directly from labels of specimens examined and host files maintained by California Department of Food and Agriculture lepidopterists. In the latter cases, under the "Host Plant" category of each species, these records are listed last and without a citation following. Larval host records of the Canada Forest Insect Survey (Prentice, 1962) supplied much data on the conifer feeders. In the latter case, the host records and insect species were verified by rearing on the host from which the larvae were taken. An index to host plants (p. 116) is provided for quick reference.

A list of references is provided under each generic and species heading. This is by no means a complete bibliography but includes papers in which changes in nomenclature, regarding their history and pertinent synonymy-

mies, have been made. The first entry in each case is to the original description of the taxa.

Due to the circumstances under which this study was conducted, we could not study all the type material pertaining to the included species. Whenever possible, this material has been examined and lectotypes designated if necessary. In those instances where syntypes are deposited at more than one institution and insufficient syntypic material was examined, lectotype designations have been deferred, pending review of the unexamined material. The information provided concerning location of types is based on personal examination of the type material when possible, or has been extracted from various sources in the literature and through personal correspondence. Where questionable, the data are preceded by a question mark. Type locality data are essentially as found in the original descriptions with an occasional addition (State, district, Province, and so forth) for clarity.

The keys to species are mostly artificial. The genera are arranged according to their phylogenetic relationships as interpreted by us. Taxonomic changes instituted here are discussed in the appropriate generic or specific category.

Diagnostic Characters

The male and female genitalia were described generally for each genus and for each species. For the species of *Syngrapha*, few generalizations could be made; thus, the species descriptions of the genitalia are presented in detail. The species of *Autographa* are more homogeneous than those of *Syngrapha*; therefore, the species descriptions in the latter genus are usually short, and references to structures as "typical" indicate that these structures conform to the characterization in the generalized description of the genus.

The male genitalia (fig. 18)³ have many structures of diagnostic significance. Those most often used in this report are as follows: The aedeagus as used here is the whole tubular structure, often bulbous at the base, which

houses the inverted, membranous vesica. Any sclerotized, spinelike, or rodlike structure on the vesica is referred to as a cornutus. The terms "basal" and "apical cornuti," as used here, need a note of explanation. Since McDunnough's 1944 work, a new technique has been developed that allows one to evert the vesica. When everted, what McDunnough refers to as the basal cornutus becomes apical in position and the apical cornutus is basal in position. This everting technique has the advantage of displaying the proper placement of structures and their relationships on the vesica in addition to showing the size and conformation of the vesica.

The valves are two lateral, somewhat flattened, elongated structures, projecting caudad. The thickly sclerotized section along the dorsal side is called the costa, and the dorsal edge is referred to as the costal margin. The ventral

³ Illustrations begin on p. 64.

side, and base of valve, is termed the "sacculus" and is often expanded. The clavus is defined here as a filiform or knoblike projection originating on the mesodorsal margin of the sacculus near the base of the valve. The clavus is rounded and setose on the apex. The term "ampulla" is used here to indicate the entire structure arising from the center near the midpoint of the valve, more often basad than centrad. The ampulla may be only a small knob, produced apically into a sharp spine, or long and slender, rounded and setose at the apex. The length of the valve was measured from the most anterior basal portion to the caudal end.

The valves articulate basad on their mesal surfaces with a platelike or shield-shaped sclerite called the juxta. It is most often produced to a pointed apex, sometimes with a distinct and sclerotized projection on the apex referred to as the spine of the juxta.

The tegumen was measured from the point of articulation with the uncus to the basal end where it becomes narrow, not from the point of articulation with the valve.

The cornutus often has a sclerotized plate extending from its base. When measuring the length of the cornutus to its tip, the plate was not included. Measurements of the length of the aedeagus did not include the membranous, apical extension, which is attached to the genital capsule.

The female genital structures most often used (fig. 19) are the ostium bursae, ductus bursae, corpus bursae, and ductus seminalis.

The ostium bursae is that differentiated section from the external opening or ostium to the point where the ductus bursae originates. In the great majority of species, the ostium bursae is well defined, sclerotized, and pigmented.

The ductus bursae is most often elongate, sinuous, tubular, partially sclerotized, and strigose. It most often enters anterior to the caudal end of the corpus bursae.

The corpus bursae is usually a membranous sac but may have areas of pigmentation and sclerotization. The cephalic end is called the fundus, and the caudal end is the apex, either or both of which may be somewhat defined by a constriction or elongation of the corpus bursae

on the ends. The apex may be shagreened, sclerotized, pigmented, strigate, or curved right or left. The ductus seminalis is a very thin duct arising from the apex in most species, but arises from the fundus in a few species.

Measurements of the length of the ductus bursae were made in a straight line from the base of the ostium bursae to the point of entrance into the corpus bursae, without stretching or altering the normal shape of the ductus bursae. Reference to the width of the ostium bursae means at its greatest width, which is usually the caudal end and from a dorsal or ventral aspect. The length of the corpus bursae was determined from the tip of the apex to the tip of the fundus in a straight line, without disturbing its normal shape.

A portion of this study is concerned with the differentiation of preserved larval forms of plusiines. Chaetotaxy and other characters of the integument (fig. 1) were used along with structures on the mouth parts, since these are not structures that can become altered during fixation and preservation. A character of the hypopharynx first described by Eichlin and Cunningham (1969), referred to as the raduloid (Eichlin, 1975), made possible the differentiation of some species of larval Plusiinae, which were previously inseparable. The presence of the raduloid can be determined without removing the hypopharynx and can be observed by deflecting the maxillary palpus. The processes or ridges on the raduloid were counted with the aid of a compound microscope by observing the mentum, which was removed and mounted in glycerine in a microculture slide. Many specimens of the same species were examined from throughout its range with the result that the number of ridges on the raduloid apparently does not vary. For this reason, no range of the number of ridges was given under those species' descriptions where the number of ridges on the raduloid was used as a specific attribute. The stereoscopic microscope provided sufficient magnification to study the other larval structures. The setal nomenclature used in this study is that of Hinton (1946).

An analysis of the species of Plusiinae follows, presented according to the following for-

mat: Keys to the genera of the three tribes of plusiinae adults; a key to the species of known plusiine larvae, which includes species from 13 of the 17 plusiine genera; keys to the species of each genus based on male and female genitalia; descriptions of higher taxa and adults and

known larvae within each genus. A discussion of deduced phylogenetic relationships follows the section on the analysis of the genera and species. The adult wing patterns are not described, but photographs of every species are provided for comparison.

Key to Genera of Plusiine Adults

1. Fore wing dorsally with transverse ridges of raised scales 2
Fore wing smoothly scaled 3
2. Wing length more than 15 mm *Mouralia* Wlk. (p. 11)
Wing length less than 15 mm *Abrostola* Och. (p. 9)
3. All tibiae spined, or hind tibiae spined on terminal portion or with a few weak spines between spurs 4
No tibiae spined 6
4. Outer margin of fore wings straight or slightly concave *Autoplusia* McD. (p. 18)
Outer margin of fore wings convex 5
5. Males with clavus long and slender (fig. 26); females with ductus bursae entering corpus bursae ventrad; (*Syngrapha ottolenguii* males will key here also, but are spined only on hind tibiae, while *Rachiplusia* is spined on all tibiae) *Rachiplusia* Hamp. (p. 20)
Males with clavus short with wide base (fig. 88); females with ductus bursae either not entering corpus bursae ventrad or if entering ventrad then ductus bursae flattened and L-shaped in ventral aspect *Syngrapha* Hüb. (p. 35)
6. Abdomen of males with lateral tufts of long scales on segments 4 and 5; females with ductus seminalis arising from the fundus (fig. 115) or if from the apex, the ductus bursae is longer than the abdomen (fig. 126) 7
Abdomen of males without lateral tufts of long scales on segments 4 and 5; females with ductus seminalis arising from the apex of corpus bursae where ductus bursae is shorter than abdomen (fig. 132) or from the end of a long, tubelike apex (fig. 123) 8
7. Caudal end of valves in males expanded, broadly rounded (fig. 31); females with ductus seminalis arising from the apex of corpus bursae, ductus bursae longer than abdomen (fig. 129) *Trichoplusia* McD. (p. 14)
Valves in males narrow throughout (fig. 24); females with ductus seminalis arising from the fundus, ductus bursae shorter than abdomen *Argyrogramma* Hüb. (p. 12)
8. Males with long filiform ampullae on valves, vinculum produced to a long, fine point (fig. 28); females with ductus seminalis arising from the end of a long, tubelike apex (fig. 123) *Pseudoplusia* McD. (p. 16)
Males with ampullae and vinculum different from those described above; females with ductus seminalis arising from short apex of corpus bursae (fig. 124) 9
9. Labial palpi long and curved outward at tip *Polychrysia* Hüb. (p. 23)
Labial palpi not curved outward at tip, directed dorsad 10
10. Segment 3 of labial palpi long, acuminate 11
Segment 3 of labial palpi shorter, rounded apically 13
11. Fore wings with outer margin excised behind apex; palpal segment 3 hairy ventrad *Pseudeva* Hamp. (p. 25)
Fore wings with outer margin evenly rounded; palpal segment 3 not hairy ventrad 12
12. Fore wings short, apex rounded, and outer margin convex *Chrysanympa* Grt. (p. 26)
Fore wings long and narrow, apex pointed, and outer margin oblique ... *Eosporopteryx* Dyar (p. 26)
13. Dorsal abdominal tufting lacking or greatly reduced *Chrysaspidia* Hüb. (p. 52)
Dorsal abdominal tufting well developed, especially on segment 3 14
14. Males with clavus undeveloped (fig. 33), antennae moniliform; females with ductus bursae entering corpus bursae dorsad, ductus bursae with no excessory structure near entrance to corpus bursae. *Adeva* McD. (p. 24)
Males with clavus long and thin (fig. 47), antennae finely ciliate; females with ductus bursa not entering corpus bursae dorsad or if dorsad, ductus with a large, oval spiculate sac near entrance to corpus bursae (fig. 119) 15
15. Fore wing with well-developed metallic sign, outer margin rounded *Autographa* Hüb. (p. 27)
Fore wing without metallic sign, outer margin slightly falcate 16
16. Males with apex of sacculus highly modified (fig. 35); females without spiculate sac laterally on ductus bursae *Allagrapha* Franclemont (p. 21)
Males with apex of sacculus not modified (fig. 29); females with spiculate sac laterally on ductus bursae (fig. 119). *Plusia* Och. (p. 21)

Key to the Known Species of Plusiine Larvae

1. Prolegs present on abdominal segments 3 and 4. 2
Prolegs absent or vestigial on abdominal segments 3
and 4 (fig. 1) 4
2. Mandible with a wide gap between dentes 2 and 3
(fig. 5) *Mouralia tinctorides*
Mandible without wide gap between dentes 2 and 3
..... 3
3. Abdominal segments 1 and 2 with seta D-2 at poste-
rior end of narrow pale area *Abrostola urentis*
Abdominal segments 1 and 2 with a conspicuous
white or pale spot including seta D-2
..... *Abrostola ovalis*
4. Seta SV-2 present on abdominal segment 1 (fig. 9)
..... 5
Seta SV-2 absent on abdominal segment 1 (fig. 8)
..... 14
5. Setae SV-1 and SV-2 present on meso- and meta-
thorax 6
Seta SV-2 absent on meso- and metathorax 8
6. Raduloid present on hypopharynx (fig. 12)
..... *Syngrapha u-aureum*
Raduloid absent on hypopharynx 7
7. Pinacula and areas surrounding bases of setae dark;
interval between pinacula of setae V-1 on ab-
dominal segment 4 more than one-half to sub-
equal to interval between pinacula of seta V-1
and seta SV-1 (fig. 15) . *Syngrapha rectangula*
S. alias
S. celsa
S. parilis
Pinacula and areas surrounding bases of setae not
dark; interval between pinacula of setae V-1 on
abdominal segment 4 one-half the interval be-
tween the pinacula of seta V-1 and seta SV-1
(fig. 16) *Syngrapha microgamma*
8. Ribs 2 and 3 of mandible terminating in processes
before reaching cutting margin (fig. 2) 9
Ribs 2 and 3 of mandible not terminating in pro-
cesses but continuing to cutting margin (fig. 7)
..... 10
9. Bases of setae on head and venter of thorax with
dark annuli *Autographa mappa*
Bases of setae on head and venter of thorax not
darkened *Autographa ampla*
10. Raduloid of hypopharynx present (fig. 12) 11
Raduloid of hypopharynx absent 12
11. Interval between pinacula of the two V-1 setae on
abdominal segment 4 one-half the interval be-
tween pinacula of V-1 and SV-1 (fig. 16)
..... *Syngrapha selecta*
Interval between pinacula of the two V-1 setae on
abdominal segment 4 more than one-half to sub-
equal to the interval between pinacula of V-1
and SV-1 (fig. 15) *Syngrapha epigaea*
12. Crochets uniordinal; ventral edge of mandible
curved inward (fig. 3) .. *Chrysaspidia contexta*
C. putnami
Crochets biordinal; edge of mandible not as above
..... 13
13. Head spotted; middorsal band formed of dark micros-
pines *Syngrapha viridisigma*
S. orophila
Head immaculate; microspines minute, not forming
distinct dorsal band *Syngrapha falcifera*
14. Vestigial prolegs present on abdominal segments 3
and 4 (fig. 1) 15
Vestigial prolegs absent on abdominal segments 3
and 4 18
15. Ribs 2 and 3 of mandible terminating in processes
before reaching cutting margin (fig. 2) 16
Ribs 2 and 3 of mandible not terminating in pro-
cesses but continuing to cutting margin (fig. 7)
..... *Trichoplusia ni*
16. Abdominal segment 2 with pinaculum of seta SV-1
closer to SV-2 than to SV-3
..... *Argyrogramma basigera*
Abdominal segment 2 with pinacula of setae SV-3,
SV-1 and SV-2 approximately equidistant from
one another 17
17. 10 ridges on raduloid *Pseudoplusia includens*
13 ridges on raduloid *Argyrogramma verruca*
23 ridges on raduloid ... *Trichoplusia oxygramma*
18. At least one rib of mandible terminating in process
before reaching cutting margin 19
None of the ribs of mandible terminating in pro-
cesses but continuing to cutting margin 27
19. Pinacula of setae SV-1 and SV-2 at least partially
fused on abdominal segment 2 (fig. 10) 20
Pinacula of setae SV-1 and SV-2 separated on ab-
dominal segment 2 (fig. 11) 23
20. Ribs 2 and 3 of mandible terminating in processes
before reaching cutting margin (fig. 2) 22
Only rib 2 of mandible terminating in process before
reaching cutting margin (fig. 6) 21
21. Raduloid of hypopharynx present (fig. 12)
..... *Autographa rubida*
Raduloid of hypopharynx absent
..... *Polychrysis morigera*
22. Head with a black, lateral stripe including ocelli 1-6
..... *Autographa precatonensis*
Head without black, lateral stripe
..... *Autographa bimaculata*
23. Ribs 2 and 3 of mandible terminating in processes
before reaching cutting margin (fig. 2) 25
Only rib 2 of mandible terminating in process before
reaching cutting margin, occasionally also on rib
3, but then with setal pinacula of head ringed
with black 24
24. Raduloid with 23 minute ridges; dorsal abdominal
setae on protruding conical pinacula
..... *Autoplusia olivacea*
Raduloid with 12 minute ridges; dorsal abdominal
setae without strongly prominent pinacula
..... *Autoplusia egea*

25. Abdominal segment 2 with pinaculum of seta SV-2 closer to SV-1 than to V-1 (fig. 14)
 *Allagrapha aerea*
 Abdominal segment 2 with pinaculum of seta SV-1, SV-2 and V-1 approximately equidistant from one another (fig. 13) 26
26. Raduloid of hypopharynx present (fig. 12)
 *Allagrapha aeroides*
 Raduloid of hypopharynx absent .. *Plusia balluca*
27. Pinacula of setae SV-1 and SV-2 at least partially fused on abdominal segment 2 (fig. 10) 28
 Pinacula of setae SV-1 and SV-2 separated on abdominal segment 2 (fig. 11) ... *Rachiplusia ou*
28. Integument with microspines .. *Autographa biloba*
 Integument without microspines, but with minute granules *Autographa californica*

Tribe ABROSTOLINI, New Tribe

The Abrostolini, the most primitive tribe in our interpretation, is characterized in the adult form by having areas of raised scales on the fore wings; tibiae without spines; male genitalia with a clavus in the form of a sclerotized, platelike projection from the costa margin of the sacculus; and ampulla uniquely spatulate. The larvae have prolegs on abdominal segments 3 and 4, though slightly reduced on the third; and a raduloid on the hypopharynx. This tribe is represented in the North American fauna by two genera, *Abrostola* and *Mouralia*, with five species.

Abrostola Ochsenheimer

Generotype.—*Noctua triplasia* Linnaeus, 1758, p. 517. Designated by Stephens, 1829, p. 96.

Abrostola Ochsenheimer, 1816, p. 88.

Adult and larval features generally as described for the Abrostolini.

KEY TO THE SPECIES BASED ON MALE GENITALIA

1. Ampulla spatulate, incurved, extending beyond costa; clavus wide, about same width throughout (fig. 21a) *urentis*
 Ampulla narrow, pointed, outcurved at least apically, not extending to costa; clavus narrow at base, expanded, ovate apically (fig. 22) 2
2. Vesica with at least two distinct patches of many small cornuti; ampulla much outcurved with apex directed somewhat ventrad (fig. 22). ... *microvalis*
 Vesica with one continuous patch of cornuti; ampulla outcurved only slightly at apex (fig. 20) *parvula*
- [Male of *ovalis* not keyed out, no material examined.]

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

1. Corpus bursae large and elongate (fig. 88) ... *ovalis*
 Corpus bursae small and oval (fig. 93) 2

2. Corpus bursae with sclerotized, pigmented plate dorsad (figs. 89 and 92) *parvula*
microvalis
 Corpus bursae without sclerotized plate (fig. 93)
 *urentis*
- [For separation of *parvula* and *microvalis*, refer to adult figures (fig. 159 and 160).]

Abrostola urentis Guenee

Figure 158

Abrostola urentis Guenee, 1852, p. 322.

Male genitalia (fig. 21).—Uncus long, thin, and pointed but unspined apically; vinculum broadly rounded; valve with wide, sclerotized clavus, round and distal end, located near base of sacculus; valve with costa produced into a large hump near middle, causing valve to be twice as wide at this point than elongate caudal one-half; ampulla from a thick, inward projecting base, spatulate, strongly incurved; aedeagus with patch of spines external on dorsum of apex, internally near apex with a ventral, bifurcate, sclerotized plate with two sharp projections on right edge, and dorsally with a cluster of 4 small cornuti on vesica, with another cluster of about 12 cornuti just cephalad of first cluster.

Female genitalia (fig. 93).—Two outward projecting, sclerotized, pigmented, granulose pouches laterad on cephalic end of abdominal segment 8; ostium bursae, sclerotized, granulose, wider than long, expanding laterad and somewhat constricted at base; ductus bursae initially narrow, granulate and sporadically sclerotized and membranous, making right angle bend to left and another bend cephalad, gradually widening to about twice its initial width as it enters corpus bursae on left side; corpus bursae obovate, strigate caudad.

Larvae.—Prolegs present on abdominal seg-

ments 3-6, though slightly thinner on abdominal segment 3; abdominal segment 8 gibbose subdorsad; head reticulate; mandible with mesal processes on rib 2; raduloid on hypopharynx with 16 ridges; crochets average 20 to 28 in number; abdominal segment 2 with pinacula of setae SV-1 and SV-2 widely separated; abdominal segment 1 with SV-2 absent; and SV-2 absent on meso- and metathorax; no microspines on integument; overall, very similar to *M. tinctoides*.

Type.—British Museum (Natural History).

Type locality.—New York.

Host plant.—*Urtica lyalli* Tietz (1972), *Urtica dioica*.

Range (map 10).—Nova Scotia to British Columbia; United States except for southeast (no verified records from California, Eichlin, 1975).

Comments.—Larval specimens and the parental female were borrowed from the Canadian National Collection, Ottawa, Ontario.

Abrostola parvula Barnes and McDunnough

Figure 159

Abrostola parvula Barnes and McDunnough, 1916, p. 225.

Abrostola mariana Walter, 1928, p. 139.—Benjamin, 1932, p. 7.

Male genitalia (fig. 20).—Uncus pointed but not terminated in a spine; valve with ampulla slightly outcurved near apex and not, or slightly, directed caudad; valve very narrow but expanded near the middle on costal edge to a high, rounded hump, basad of which is a mushroom-shaped, flat, sclerotized clavus; aedeagus with an apical patch of many small spinelike cornuti on vesica.

Female genitalia (fig. 89).—Ostium bursae a short but very wide membranous pouch with lateral membranous extensions caudad; laterally attached to these extensions are slightly sclerotized, cup-shaped pockets open caudad; ductus bursae, short, membranous, about one-third as wide as ostium bursae and curved left as it enters corpus bursae on the right side; corpus bursae a small oval sac with an evenly sclerotized and pigmented plate (signum) dorsad of ductus bursae entrance, rounded cephalad and pointed caudad; ductus seminalis

arises from poorly defined apex on the left side of corpus bursae, cephalad of entrance of ductus bursae. (Described from USNM Type #41021.)

Types.—A male syntype of *parvula* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype; "*Abrostola parvula* B & McD, Type ♂/So. Arizona, Poling/♂ gen. 353, 13 Aug 32, FHB." The holotype male of *mariana* is also in the National Museum of Natural History.

Type localities.—Southern Arizona (*parvula*). Tempe, Ariz. (*mariana*).

Host plant.—Unknown.

Range (map 8).—Arizona, California.

Abrostola microvalis Ottolengui

Figure 160

Abrostola microvalis Ottolengui, 1919, p. 124.

Male genitalia (fig. 22).—Description of male genitalia the same as for *parvula* with the following exceptions: Valve with ampulla strongly outcurved and projected caudad; aedeagus with an apical and median patch of many small, spinelike cornuti on vesica.

Female genitalia (fig. 92).—From the specimens available, no consistent differences from *A. parvula* in female genitalia could be ascertained. Both species are very rare in collections.

Type.—Holotype male in the American Museum of Natural History.

Type locality.—Texas.

Host plant.—Unknown.

Range (map 9).—Texas, Arizona.

Abrostola ovalis Guenee

Figure 161

Abrostola ovalis Guenee, 1852, p. 322.

Male genitalia.—Not examined.

Female genitalia (fig. 88).—Ostium bursae very shallow, sclerotized, shagreened, caudoventral edge folded down, with a median cleft, sides folded in deeply subdorsad, causing dorsomeson to be completely open; ductus bursae, narrow and membranous for initial, short section, abruptly expanding, becoming sclerotized, darkly pigmented, much folded, shagreened,

with a fingerlike projection ventrad, and enters corpus bursae on left side, the entrance area as long as one-third of total length of corpus bursae; corpus bursae elongate, mostly strigate, shagreened and lightly pigmented, caudal one-half sharply angled toward the right, below entrance of ductus bursae, produced ventrad as a broad, toughened ridge to apex; ductus seminalis arises from apex.

Type.—British Museum (Natural History).

Type locality.—New York.

Host plant.—*Urtica* sp., Crumb (1956).

Range (map 9).—Maine to North Carolina and Ohio.

Comments.—The larvae of *Abrostola ovalis* were not seen, but this species was placed in the larval key on the basis of information obtained from Crumb (1956).

Mouralia Walker

Generotype.—*Abrostola tinctoides* Guenee, 1852, p. 323. Designated by Hampson, 1913, p. 591.

Mouralia Walker, 1858, p. 1803

Although the larvae of this species are much like a larger version of the larvae of *Abrostola* species, the genitalia of the adults indicate that they should not be considered as congeneric. The following description of *M. tinctoides* is an adequate description for the genus as well.

Mouralia tinctoides (Guenee)

Figure 162

Abrostola tinctoides Guenee, 1852, p. 323.

Mouralia tinctoides: Hampson, 1913, p. 402.

Male genitalia (fig. 23).—Uncus C-shaped, broad at base, pointed at apex with a minute curved spine at tip, distal one-fourth round, basal three-fourths flat on top and much wider in the middle, from which point arises a cluster of hairlike scales; rectum near base of uncus with two subdorsal, sclerotized, somewhat triangular projections; juxta simple, shieldlike; vinculum not extending much beyond base of valves, broadly rounded at apex; valves thickly covered on inner surface with hairlike scales, particularly on sacculus all along ventral edge of valve to apex, valve widest near middle,

tapering to spoon-shaped apex, covered ventrally with hairlike scales and dorsally with long, spatulate scales; ventrolateral margin of juxta with slender, sclerotized furca, just caudad of which is a sclerotized, lobed clavus; in center of valve are three projections, the center one being here considered as the actual ampulla, which is narrow, rounded at apex, incurved, and projected toward sacculus; slightly above ampulla and toward base of valve is a thick, short editum; below and caudad of ampulla is a spatulate clasper, wider than and subequal in length to ampulla. Aedeagus relatively small, about as long as tegumen, and apically with a small cornutus on a broad, rounded base, and a club-shaped projection off vesica covered with small, broad spines.

Female genitalia (fig. 90).—No ductus bursae as such, but with ostium bursae broad and short, slightly longer than wide, sclerotized, and partially strigate, leading directly into corpus bursae mesoventrad; corpus bursae thinly membranous, right side of corpus bursae produced cephalad into a narrow, elongated fundus, left side produced cephalad into an elongate but shorter apex, about one-third as long as fundus, and slightly spiculate; ductus seminalis arises near tip of apex.

Type.—Two male syntypes in Guenee Collection, [?] British Museum (Natural History).

Type locality.—Brazil.

Host plants.—*Tradescantia fluminensis* (wandering-Jew or spiderwort in part); *Zebrina pendula* (wandering-Jew in part).

Range (map 10).—Florida, Texas, and California; south to Brazil.

Comments.—This species is considered to be closely related to *Abrostola* mainly because the larval form is very similar to the larvae of *urentis* and *ovalis*. The setal arrangement is the same. A slight difference from the mandible of *tinctoides* and a difference from *urentis* in the number of ridges on the raduloid of the hypopharynx were the only differentiating characters found. Though the male genitalia are highly modified, they still have characters peculiar to the *Abrostolini*, such as the odd, platelike clavus on the costal margin of the sacculus. Larvae were from the National Museum of Natural History.

Tribe ARGYROGRAMMINI, New Tribe

The Argyrogrammini is for the most part southern in distribution, ranging into the Tropics for *Trichoplusia ni* and *Pseudoplusia includens*, which are generally distributed in the north temperate zone of America as well. This tribe corresponds to Kostrowicki's Group A (1961, p. 369). The adults have no tribal spines; males have a well-developed, elongate clavus and saccus; and, except for *P. includens*, males have strong lateral tufts of scales caudad on the abdomen. The larvae have a raduloid on the hypopharynx; and the prolegs on abdominal segments 3 and 4 are vestigial, being reduced to minute, peglike structures having no crochets. The Argyrogrammini in North America is composed of three genera, *Argyrogramma*, *Pseudoplusia*, and *Trichoplusia*, which include six species.

Kostrowicki (1961), Dufay (1970), and Ichinose (1962 and 1973) differ as to the generic concepts within the Argyrogrammini. According to the larval key to genera in Ichinose (1962), the species of this tribe in North America are all congeneric with *Chrysodeixis* Hüb. Ichinose (1973) synonymizes *Trichoplusia* with *Argyrogramma* and *Pseudoplusia* with *Chrysodeixis*. The larvae of the Nearctic species do not fit the generic limits as defined by Ichinose. The larvae of the type species for the genus *Argyrogramma*, *A. verruca* (Fab.), do not fit his character whereby, "...D₁ on T₂ not so close to D₂, situated on the imaginary line connecting D₂ and SV₂." As a matter of fact, the species is similar to the character state described for *Chrysodeixis* whereby, "...D₁ on T₂ near to D₂, situated just behind the imaginary line connecting D₂ and SD₂," but the larval form does not agree on a second character state of the latter genus. In like fashion, *Pseudoplusia includens* larvae are similar to *Chrysodeixis* on one character but differ from this genus on a second.

One could perhaps synonymize all of the above genera of the Argyrogrammini under *Chrysodeixis* and redefine the genus. Dufay (1970), relying on genitalic differences and the last abdominal sclerite of the males, does not agree with Ichinose's concept of *Chrysodeixis*

and states that *Trichoplusia* cannot be congeneric with it. He also finds Kostrowicki's placing of seven species in *Argyrogramma* to be an erroneous application of the limits of this genus.

A more accurate interpretation of these genera probably lies somewhere in between the concepts based strictly on adults or mostly on immatures. To add further to the problem, Nakamura (1974) states that based on pupal chaetotaxy, the generic concepts of both Dufay and Ichinose, as regards *Chrysodeixis*, *Argyrogramma*, and *Trichoplusia*, are apparently somewhat in error, because species of each genus, as recognized by those authors, fit into more than one of Nakamura's categories.

The limited representation of this tribe in the Nearctic does not permit us to resolve the controversy at this time. We believe a thorough investigation of the Neotropical fauna in this complex will be necessary before more accurate conclusions can be drawn.

Argyrogramma Hübner

Generotype.—*Argyrogramma omega* Hübner [1821] (= *verruca* Fabricius, 1794).

Designated by McDunnough, 1944, p. 206.

Argyrogramma Hübner, [1821], p. 29.

Phytometra Hampson (*nec* Haworth), 1913, p. 452 (*partim*).

Autographa: McDunnough, 1938, p. 113.

Argyrogramma: McDunnough, 1944, p. 205.

The larvae and features of the males are generally as described for the tribe, the differences being more useful in a specific sense.

In North America, the females of the two *Argyrogramma* species are characterized by having the ductus seminalis arising from the fundus on the corpus bursae, a rather unusual situation in the subfamily.

KEY TO THE SPECIES BASED ON MALE GENITALIA

- | | |
|---------------------------------------------------------------------|-----------------|
| Aedeagus with one cornutus; apex of ampulla knobbed (fig. 25) | <i>verruca</i> |
| Aedeagus with two cornuti; apex of ampulla hooked (fig. 24) | <i>basigera</i> |

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

Ductus bursae thin, ropelike, somewhat sclerotized and strigate for most of its length (fig. 96) ... *verruca*
 Ductus bursae straplike, sclerotized throughout and strigate (fig. 91) *basigera*

Argyrogramma verruca (Fabricius)

Figure 163

Noctua verruca Fabricius, 1794, p. 81.

Plusia omega (Hübner), 1823, p. 29, figs. 373, 374; *Plusia oo* (Cramer), 1782, pl. 311, fig. e (partim); *Plusia omicron* (Hübner), 1821, p. 251.—Guenee, 1852, p. 342.

Autographa verruca: Dyar, 1902, p. 81.

Phytometra verruca: Hampson, 1913, pp. 465, 466.

Autographa verruca: McDunnough, 1916, p. 400.

Argyrogramma verruca: McDunnough, 1944, pp. 205, 206.

Male genitalia (fig. 25).—Uncus widest near apex, with large, curved, terminal spine; vinculum broad, same width throughout, truncate at apex; valve elongate, rounded apically, with short, knobbed, heavily setose ampulla, and long, filiform clavus; aedeagus long, slender, only slightly expanded at base, with flat, basal cornutus, pointed at both ends, and an S-shaped, spinose plate near the middle, and a sclerotized, spinose plate near apex; apex of aedeagus externally, minutely spinose.

Female genitalia (fig. 96).—Ostium bursae small, weakly sclerotized and strigate; ductus bursae slender, initial short portion S-shaped when viewed from the left side, membranous, becoming somewhat sclerotized, granulate, and strigate, bending dorsally and laterad toward the left, entering the corpus bursae dorsally toward the right of meson; corpus bursae finely spiculate, tapering to a blunt fundus from which arises the ductus seminalis.

Larvae.—Prolegs vestigial on abdominal segments 3 and 4, reduced to small peglike structures (fig. 1): No microspines on integument; mesothorax with pinaculum of D-2 closer to D-1 than to SD-2; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; pinaculum of seta SV-2 equidistant from SV-3 and SV-1 on abdominal seg-

ment 2; crochets range from 17 to 20 in number; dark, lateral band on head if present, apparently not including ocelli 1-4; ribs 2 and 3 of mandible terminating in processes before reaching cutting margin; raduloid on hypopharynx with 13 ridges.

Type.—Fabricius Collection, Kiel, Denmark, [Zimsen, 1964] (*verruca*). [?] Lost (*omega*). [?] Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands (*oo*). [?] Lost (*omicron*).

Type locality.—South America (*verruca*). Savanna, Ga. (*omega*). [?] (*oo*). [?] (*omicron*).

Host plant.—*Sagittaria* sp., Forbes (1954); *Gossypium hirsutum*, *Justicia americana*, *Nicotiana tabacum*, *Vigna unguiculata*; Crumb (1956); *Calendula* sp., Kimball (1965); *Rumex crispus*, Eichlin and Cunningham (1969); *Polygonum punctatum*, *P. setaceum*, Heppner and Habeck (1976); *Hyptis* sp., *Mentha* sp., *Pelargonium* sp., *Spathiphyllum* sp., *Tradescantia fluminensis*, *Trichosporum* sp.

Range (map 4).—Ontario, Maine to Florida, west to Colorado, and south to tropical South America.

Comments.—Parental females of laboratory cultures were collected from a light trap at Auburn, Ala.

Argyrogramma basigera (Walker)

Figure 164

Plusia basigera Walker, 1865, p. 836.

Plusia laticlavia Morrison, 1875, p. 98.—Smith, 1893, p. 225.

Autographa basigera: Dyar, 1902, p. 81.

Phytometra basigera: Hampson, 1913, pp. 486, 487.

Autographa basigera: McDunnough, 1916, p. 400.

Argyrogramma basigera: McDunnough, 1944, pp. 205, 206.

Male genitalia (fig. 24).—Uncus thin throughout, with terminal spine; vinculum narrow, elongate, bluntly pointed at apex; valve elongate and rounded apically; with relatively long ampulla, strongly hooked at apex, directed cephalad, and long filiform clavus; aedeagus long and slender, expanded at base, with flat, basal cornutus rounded at both ends and a sharply

pointed median cornutus, apex of aedeagus externally, minutely spinose; juxta relatively narrow, strongly keeled medially.

Female genitalia (fig. 91).—Ostium bursae small; ductus bursae initially narrow but abruptly expands to as wide as widest part of ostium bursae, the caudal one-half of ductus bursae flat and granulose, becoming more heavily sclerotized, strigate and twisted, entering the corpus bursae dorsally toward the right; corpus bursae narrow about four times longer than wide, blunt at apex and tapering to a blunt point cephalad, with ductus seminalis arising from fundus.

Larvae.—Mesothorax with pinaculum of seta D-2 equidistant from D-1 and SD-2; pinaculum of SV-2 closer to SV-1 than to SV-3 on abdominal segment 2; crochets range in number from 20 to 23; dark, lateral band on head, if present, including ocelli 1-6 in all specimens examined; raduloid on hypopharynx with 17 ridges; otherwise very similar to *verruca*.

Type.—Female, Carter's collection, British Museum (Natural History) (*basigera*). Tepper Collection, Michigan State University (*lati-clavia*).

Type locality.—North America (*basigera*). New York (*lati-clavia*).

Host plant.—Unknown.

Range (map 1).—Maine south to Florida, west to Texas and Mexico.

Comments.—Parental females of laboratory cultures were collected at a black light in Gainesville, Fla., and from a light trap at Auburn, Ala.

Trichoplusia McDunnough

Generotype.—*Plusia ni* var. *brassicae* Riley, 1870, p. 110. Original designation.

Trichoplusia McDunnough, 1944, p. 204.

Chrysodeixis: Ichinose, 1962, p. 95.

Trichoplusia: Dufay, 1970, p. 15.

Argyrogramma: Ichinose, 1973, p. 138.

Chrysodeixis: Nakamura, 1974, p. 6.

As previously mentioned in the discussion of the *Argyrogrammini*, we will not attempt here to resolve the controversy surrounding the generic limits of *Trichoplusia*, *Chrysodeixis*, and *Argyrogramma* worldwide, having been unable

to study the foreign material under question first hand. At this time, we prefer to view *Trichoplusia* as interpreted by McDunnough (1944), recognizing that this interpretation is based on the very limited North American *Argyrogrammini* fauna.

Though modified, the male genitalia in general form are as described for the tribe. The characters of the genitalia are most useful for specific determinations.

The female genitalia are characterized by the unique development of the ductus bursae, which is extremely long and tapelike. The ductus seminalis arises from an elongate, narrowed apex of the corpus bursae.

KEY TO THE SPECIES BASED ON MALE GENITALIA

- Ampulla produced caudad, then making a right angle bend dorsad, sickle shaped (fig. 34) *ni*
 Ampulla long and thin, protruding well above valve (fig. 30) *oxygramma*

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

- Ductus bursae does not enter through a pouch on corpus bursae (fig. 102) *ni*
 Ductus bursae enters corpus bursae through a long membranous pouch on left side of corpus bursae (fig. 105) *oxygramma*

Trichoplusia ni (Hübner)

Figure 165

Noctua ni Hübner, [1800-1803], pl. 58, fig. 284.

Autographa ni: Hübner, 1821, p. 251.

Plusia ni: Treitschke, 1823, p. 189.

Plusia ni: Grote, 1873, p. 147 [= *brassicae*].

Plusia echinocystidis Strecker, 1874, p. 94.—Smith, 1893, p. 253.

Phytometra ni: Hampson, 1913, pp. 468-470.

Autographa ni: McDunnough, 1916, p. 400.

Autographa brassicae (Riley), 1870, p. 110.—McDunnough 1938, p. 113.

Trichoplusia ni: McDunnough, 1944, p. 204.

Male genitalia (fig. 34).—Tegumen long and slender; vinculum long, tapering to a point; valve widest at broadly rounded apex with sickle-shaped ampulla produced dorsad as a thin point, passing just beyond costal margin of valve, and clavus slightly shorter than width of valve at this point; aedeagus about as long as

valve, slender for most of its length, bulbous at base, with no cornuti.

Female genitalia (fig. 102).—Ostium bursae small, almost spherical, dorsal surface membranous, vertically strigate laterad and smoothly sclerotized ventrad; ductus bursae initially one-half the width of ostium bursae and membranous, but quickly and abruptly expanding to as wide as ostium bursae and continuing to left side of corpus bursae as a strigate, sclerotized, narrow ribbonlike tube, extremely long, being about 4 to 5 times longer than length of corpus bursae; corpus bursae saclike, narrowing to a blunt point at apex from which arises the ductus seminalis.

Larvae.—Prolegs on abdominal segments 3 and 4 vestigial, reduced to tiny peglike structures around the bases of which are clustered setae SV-2, SV-3, and V-1; seta SV-2 absent on abdominal segment 1; seta SV-2 absent on meso- and metathorax, on mesothorax D-2 equidistant from D-1 and SD-2; seta SV-1 and SV-2 on abdominal segment 2 well separated, approximately equidistant from each other and seta SV-3; crochets on ventral prolegs range in number from 19 to 22; no microspines on integument; ribs of mandible not terminating in processes before reaching cutting margin; raduloid on hypopharynx with 10 ridges.

Type.—Not known to us (*ni*). A male syn-type of *brassicae* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "294,ibs. Nov. 12/75/USNM Type #275." [?] Strecker Collection, Chicago Field Museum (*echinocystidis*).

Type locality.—Not known to us (*ni*). Missouri (*brassicae*). California (*echinocystidis*).

Host plant.—*Pastinaca sativa*, Crumb (1956); *Ageratum conyzoides*, *Althaea rosea*, *Antirrhinum* sp., *Apium graveolens*, *Argemone platyceras* var. *hispida*, *Asparagus officinalis*, *Beta vulgaris*, *Brassica hirta*, *B. campestris*, *B. nigra*, *B. oleracea*, *B. rapa*, *Calendula officinalis*, *Chaenactis stevioides*, *Chaenomeles japonica*, *Chenopodium album*, *Chrysanthemum* sp., *Citrullus vulgaris*, *Crepis* sp., *Cucurbita maxima*, *C. melo*, *C. sativus*, *Dianthus caryophyllus*, *Erodium* sp., *E. circuitarium*, *Eschscholzia californica*, *Geranium* sp., *Gossypium* sp., *Lactuca canadensis*, *L. sativa*, *Lathyrus odoratus*, *Malva*

sp., *Mentha* sp., *Nicotiana glauca*, *N. tabaccum*, *N. trigonophylla*, *Pectis papposa*, *Phaseolus vulgaris*, *Pisum sativum*, *Plantago* sp., *Raphanus sativus*, *Reseda odorata*, *Rumex* sp., *Senecio cruentis*, *S. mikanioides*, *Smilax rotundifolia*, *Solanum tuberosum*, *Spinacea oleracea*, *Taraxacum officinale*, *Trifolium* sp., *Tropaeolum majus*, *Vigna sinensis*, (Tietz, 1972); *Acacia greggii*, *Asclepias* sp., *Bergenia* sp., *Brassica napus*, *Cineraria* sp., *Citrus* sp., *C. sinensis*, *Coleus* sp., *Crotalaria rotundifolia*, *Cucurbita pepo*, *Daucus carota*, *Euphorbia pulcherrima*, *Fragaria* sp., *Helianthus* sp., *Hibiscus esculentus*, *Ipomoea purpurea*, *Lativa* sp., *Lupinus* sp., *Lycopersicon esculentum*, *Medicago sativa*, *Papaver* sp., *Petunia* sp., *Phaseolus* sp., *P. limensis*, *P. lunatus*, *Philodendron* sp., *Rumex crispus*, *Salvia* sp., *Tribulus* sp., *Zea mays*.

Range (map 6).—United States and Southern Canada; south to Tropics.

Comments.—This species is commonly termed the cabbage looper. Parental females of laboratory cultures were collected in a light trap at Auburn, Ala., and near Pittsburgh, Pa.

Trichoplusia oxygramma (Geyer)

Figure 166

Autographa oxygramma Geyer, 1832, p. 37, figs. 769, 770.

Plusia oxygramma: Guenee, 1852, p. 353.

Autographa oxygramma: Dyar, 1902, p. 81.

Autographa indigna (Walker) 1857, pp. 909, 910—Ottolengui, 1902, p. 67.

Phytometra oxygramma: Hampson, 1913, pp. 494, 495.

Autographa oxygramma: McDunnough, 1916, p. 400.

Trichoplusia oxygramma: McDunnough, 1944, p. 204.

Male genitalia (fig. 30).—Tegumen shorter and wider than *T. ni*; vinculum much the same as in *ni*; valve similar in shape to *ni* but very narrow before apex with ampulla straight, slender, rounded apically, two-thirds of its length projected beyond costal margin, arising more basad midway between base and middle of valve, and clavus similar to *ni*; aedeagus longer than valve, slender and slightly expanded basally with a long, needlelike, slightly curved,

basal cornutus, and a sclerotized, elongate patch in apical one-third of aedeagus curving from dorsal side ventrad to apex.

Female genitalia (fig. 105).—Ostium bursae entirely membranous, short, about three times wider than long; ductus bursae similar to *ni*, shorter, about three to four times longer than length of corpus bursae and enters corpus bursae into a thickened, membranous pouch; corpus bursae essentially the same as *ni*.

Larvae.—Very similar to *ni* with the following exceptions: On mesothorax, D-2 closer to D-1 than to SD-2; number of crochets on ventral prolegs range from 22 to 25; mandible with ribs 2 and 3 terminating in processes before reaching cutting margin; raduloid on hypopharynx with 23 ridges; dark lateral stripe on head if present, not including ocelli 1-4 on all specimens examined.

Type.—Not known to us (*oxygramma*). Syn-types not seen by us, Milne's collection, British Museum (Natural History) (*indigna*).

Type locality.—Georgia (*oxygramma*). Georgia (*indigna*).

Host plant.—*Aster* sp., *Erigeron canadensis*, *Nicotiana tabaccum*, *Solidago* sp., Crumb (1956).

Range (map 12).—Eastern one-half and Southwest United States, south to Tropics.

Comments.—Eichlin and Cunningham (1969) reported finding numerous larvae of this species feeding on a narrow-leaved goldenrod. Though some pupae were found on this plant, where two or three leaves had been held together with silk, many more pupae were found attached to the underside of a broad-leaved species of ragweed (*Iva annua* L.) nearby in the same field upon which no larval feeding had taken place. In subsequent observations near the Tall Timbers Research Station, Tallahassee, Fla., pupae were found on *Chenopodium ambrosioides* L. and on leaves of *Acer negundo* L. (box elder) with no evidence of feeding damage. Apparently, for this species at least, many of the last-instar larvae leave their host to pupate on broad-leaved plants upon which they do not feed.

Pseudoplusia McDunnough

Generotype.—*Phalaena* oo Cramer (fig. E, not

F), 1782 = *inclusens* Walker, 1857, p. 94. Original designation.

Pseudoplusia McDunnough, 1944, p. 206.

Chrysodeixis: Ichinose, 1973, p. 139.

The genus *Pseudoplusia* contains a single species, *inclusens*. *P. inclusens* is closely related to other species of the Argyrogrammini, but due to differences in adult and larval morphology and our lack of a comprehensive treatment of this tribe in the Neotropics, we have chosen not to remove *inclusens* from *Pseudoplusia*, pending further study.

The males of this genus lack the lateral scale tufts on the abdomen, which characterize other Argyrogrammini species.

Pseudoplusia inclusens (Walker)

Figure 167

Plusia inclusens Walker, 1857, p. 94.

Plusia hamifera Walker, 1857, p. 917; *P. dyaus* Grote, 1875c, pp. 203, 204.—Smith, 1893, p. 250.

Autographa culta (Litner), 1885, pp. 94-97.—Ottolengui, 1902, p. 66.

Autographa inclusens: Ottolengui, 1902, p. 66. [=rogationis of authors, nec Guenee]

Autographa oo: McDunnough (nec Cramer), 1938, p. 133.

Pseudoplusia oo: McDunnough (nec Cramer), 1944, pp. 206, 207.

Plusia inclusens Walker, Forbes, 1954, p. 303.

Male genitalia (fig. 28).—Uncus long and slender; vinculum extremely narrow, tapering to a point; aedeagus swollen in apical one-half, constricted, then expanded again basad, base of aedeagus with patch of small cornuti; with cornutus near entrance of ejaculatory duct, and apex of aedeagus spinose; juxta narrow, produced apically to a strong, sclerotized spine; valve with basal one-half narrow, expanding gradually in apical one-half to broadly rounded apex, costa near caudal edge of tegumen produced inward as an elongate spine, curved cephalad near distal end, clavus very long and relatively thick, ampulla extremely long and filiform, longer than one-half the length of valve, arising from sacculus near base of valve.

Female genitalia (fig. 99).—Ostium bursae shallow, but flared out laterad, sclerotized, stri-

gate cephalad, and heavily shagreened; ductus bursae with initial one-half membranous, narrow at first but widening, cephalic one-half begins where ductus bursae abruptly narrows to about one-third its width, then becoming somewhat sclerotized, strigate and widening again to entrance into corpus bursae on right side; corpus bursae an elongate, shagreened, membranous sac with an extremely elongate, narrow, tubelike apex, projecting from the right of ductus bursae entrance cephalad, following the side of the main body of ostium bursae around fundus, and then caudad along left side almost to caudal end, where it terminates in a point, from which arises the ductus seminalis.

Larvae.—Prolegs vestigial on abdominal segments 3 and 4, reduced to very small, peg-like structures; no microspines on integument; mesothorax with pinaculum of D-2 closer to D-1 than to SD-2; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; crochets range in number from 22 to 25; dark, lateral band if present on head not including ocelli 1-4 on all specimens examined; ribs 2 and 3 of mandible terminating in processes before reaching cutting margin; raduloid on hypopharynx with 10 ridges.

Type.—Syntypes not seen by us, British Museum (Natural History) (*includens*). Syntypes not seen by us, British Museum (Natural History) (*hamifera*). New York State Museum,

Albany (*culta*). [?] Syntypes, British Museum (Natural History) (*dyaus*). A male syntype of *rogationis* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "*Pl. rogationis* Gn., Spec. 116g./Type *rogationis*, a/c Hofer Austral/Ex. Musaeo, Ach. Guenee/Oberthur Collection/♂ genitalia slide: USNM 51, J. G. Franclemont." [?] Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands (oo).

Type locality.—St. Domingo (*includens*). Santarem and Venezuela (*hamifera*). West Troy, N. Y. (*culta*). Texas, Jamaica (*dyaus*). North America (*rogationis*). [?] (oo).

Host plant.—*Commelina* sp., *Croton capitatus*, *Lactuca sativa*, *Medicago sativa*, *Nicotiana tabaccum*, *Phaseolus* sp., Crumb (1956); *Glycine max*, *Gossypium hirsutum*, *Solidago* sp., Eichlin and Cunningham (1969); *Brassica oleracea*, *Eupatorium* sp., *Geranium* sp., *Hibiscus esculentus*, *Pelargonium* sp., *Zebrina pendula*, Tietz (1972); *Chrysanthemum* sp., *Coleus* sp., *Lantana* sp., *Lycopersicon esculentum*, *Persea americana*.

Range (map 4).—Quebec to West Indies; Florida to California; south to South America.

Comments.—This species is commonly called the soybean looper. Parental females of laboratory cultures were collected from a light trap at Auburn, Ala.

Tribe AUTOGRAPHINI, New Tribe

The Autographini is the largest tribe in North America and is composed of the following 12 genera with 61 species: *Autoplusia*, *Plusia*, *Allagrapha*, *Rachiplusia*, *Polychrysia*, *Pseudeva*, *Adeva*, *Chrysanympha*, *Eosphoropteryx*, *Autographa*, *Syngrapha*, and *Chrysaspidia*.

The Autographini could be divided into two or three tribes based on adult characters, but has not been so treated because of the similarities of the larval forms. The tibiae are unspined in all genera with the following exceptions: In all but one species of *Syngrapha* and *Autoplusia*, only the hind tibiae are spined. *Syngrapha ignea*, however, and the genus *Rachiplusia* have all tibiae spined. In most genera, the male

clavus is long, filiform, and setose on the apex. In *Adeva* and *Pseudeva*, only a setose bump remains of the clavus and in *Syngrapha* the clavus is short and arises from a broad base. The larvae have no vestiges of prolegs on abdominal segments 3 and 4. Most species have a raduloid on the hypopharynx. The exceptions are species comprising the genera *Polychrysia* and *Chrysaspidia*, and a group of species we include in the genus *Syngrapha*. The larvae of *Chrysaspidia* are unique in the subfamily in that they have uninordinal crochets. Based on studies of larval forms, several species appear transitional between the two largest genera, *Autographa* and *Syngrapha*. The basis for the

interpretation of the relationships and definitions of these genera is presented in more detail in the section on "Phylogeny."

Autoplusia McDunnough

Generotype—*Plusia egena* Guenee, 1852, p. 328. Original designation.

Autoplusia McDunnough, 1944, p. 203.

This is essentially a Neotropical genus containing three species, one of which, *A. olivacea* (Skinner), may be endemic to the southern coastal areas of California. The other two species are clearly Tropical, extending into subtropical and warmest, temperate regions in the Southern United States.

The genitalia are unique in the subfamily. The larvae are typical for species of *Autographini*.

KEY TO THE SPECIES BASED ON MALE GENITALIA

1. Sacculus produced caudally to a long, fine, ventral point (fig. 39) *olivacea*
 Sacculus not produced caudally to a long, fine, ventral point (fig. 38) 2
2. Valve with curved, inward projecting, spinelike process on ventral margin near apex (fig. 38) *egena*
 Valve without ventral process near apex (fig. 59) *illustrata*

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

1. Ductus seminalis arises from apex of ostium bursae 2
 Ductus seminalis arises from fundus of corpus bursae (fig. 95) *illustrata*
2. Apex of corpus bursae bent dorsad over ductus bursae (fig. 107) *olivacea*
 Apex of corpus bursae twisted ventrad of ductus funnel (fig. 109) *egena*

Autoplusia olivacea (Skinner)

Figure 168

Autographa olivacea Skinner, 1917, p. 329.

Autoplusia olivacea: McDunnough, 1944, p. 203.

Male genitalia (fig. 39).—Uncus slender, no apical spine; tegumen slender; juxta narrow; elongate, clavuslike structures arise from sides of juxta; vinculum tapered to round apex; valves narrow for caudal two-thirds, apex round, before apex dorsal margin produced in-

ward as a long, slender process and ventral margin produced inward as a longer sclerotized, sharply pointed spine; sacculus greatly expanded and extended caudad on ventral margin to an elongate point, the points of both valves coming close together mesad; aedeagus longer than valve, basal one-half with many small cornuti, a long, thick, apical cornutus, and apex of aedeagus spinose.

Female genitalia (fig. 107).—Ostium bursae broad and about twice as long as wide, evenly sclerotized ventrally and entirely membranous dorsally; ductus bursae just slightly wider than ostium bursae and slightly longer, dorsoventrally flattened, evenly sclerotized throughout, entering corpus bursae ventrad; corpus bursae elongate, narrow, S-shaped from dorsal aspect, with elongate, rounded apex, having rugose strigae; ductus seminalis arises from apex of ostium bursae.

Larvae.—No vestige of prolegs on abdominal segments 3 and 4; microspines on integument; all setal pinacula of head ringed with black; crochets range from 19 to 25 in number; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; abdominal segment 2 with pinaculum of SV-1 approximately equidistant from SV-2 and V-1; abdominal segment 4 with V-1 pinacula as close to each other as V-1 is to SV-2, or slightly closer to SV-2 than to each other; on mesothorax pinaculum of seta D-2 equidistant from D-1 and SD-2; rib 2 and often rib 3 of mandible terminate in a process before reaching cutting margin; raduloid on hypopharynx with 23 ridges. Dorsal setae on protruding conical pinacula.

Type.—Academy of Natural Sciences, Philadelphia.

Type locality.—Los Angeles, Calif.

Host plant.—*Heliotropium* sp., *Lantana* sp., *Mimulus cardinalis*, *Phaseolus vulgaris*, *P. limensis*, *Senecio* sp., *S. jacobaea*.

Range (map 7).—Southern coastal California.

Autoplusia illustrata (Guenee)

Figure 169

Plusia illustrata Guenee, 1852, p. 328.

Syngrapha illustrata: Hampson, 1913, p. 437.

Autoplusia illustrata: Kimball, 1965, p. 119.

Male genitalia (fig. 59).—Uncus slender with strong, apical spine; valve with dorsal and ventral margins parallel, slightly rounded apically, clothed mesally with setaceous scales, extended from base ventrally, at apex of which are attached scale tufts; ampulla lacking; clavus elongate, slender, setose apically; apex of vinculum short, narrowly rounded; juxta elongate, somewhat keeled, but without apical spine; aedeagus thick, slightly expanded apically; vesica with short, pointed, apical cornutus, short, stout, pointed, medial cornutus, and an elongate row of approximately 25 slender cornuti medially.

Female genitalia (fig. 95).—Ostium bursae small, cone shaped, strigate, weakly sclerotized, not clearly distinct from ductus bursae; ductus bursae mostly membranous, threadlike, entering corpus bursae dorsad on right, very near apex; corpus bursae shagreened, with apex thickened internally, and with a heavily sclerotized, bilobed plate near entrance of ductus bursae; ductus seminalis arises from tip of fundus.

Type.—Female, British Museum (Natural History).

Type locality.—Haiti.

Host plant.—Unknown.

Range (map 1).—Florida; West Indies; South America.

Comments.—The ductus seminalis, which arises from the fundus of the corpus bursae, is an unusual condition in the subfamily, occurring also in females of species of *Argyrogramma*. Kimball (1965) placed *illustrata* in *Autoplusia* tentatively. The male structures tend to support this placement.

Autoplusia egena (Guenee)

Figure 170

Plusia egena Guenee, 1852, p. 328.

Autographa egena: Dyar, 1902, p. 81.

Syngrapha egena: Hampson, 1913, pp. 435, 436.

Autographa egena: McDunnough, 1916, p. 400.

Autoplusia egena: McDunnough, 1944, p. 203.

Male genitalia (fig. 38).—Similar to *olivacea* with the following exceptions: Valve without dorsal margin produced inward as slender process before apex, simply humped; sacculus though greatly expanded, not produced caudad

on ventral edge as a sharply pointed process; aedeagus more expanded basally, patch of small cornuti more extensive, occupying basal two-thirds of aedeagus, and apex not spinose.

Female genitalia (fig. 109).—Ventral posterior margin of ostium bursae greatly elongated ventrad, ostium bursae broad, evenly sclerotized, and punctate, bending ventrally to where ductus bursae arises; ductus bursae as wide as ostium bursae and ribbonlike, sclerotized, and with strigations only on right side and on into corpus bursae which it enters far down on the ventral side; apex of corpus bursae elongate, flattened, about as wide as ductus bursae, mostly membranous and strigate, bending to the left, twisting, and protruding ventrad of ostium bursae; the ductus seminalis arises from the truncate margin of the apex; corpus bursae small, tapering cephalad and granulose.

Larvae.—No vestige of prolegs on abdominal segments 3 and 4; minute microspines on integument; all setal pinacula of head ringed with black; crochets range from 24 to 26 in number; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; pinaculum of SV-1 approximately equidistant from SV-2 and V-1 on abdominal segment 2; abdominal segment 4 with pinaculum of V-1 closer to SV-2 than setae V-1 are to each other; on mesothorax pinaculum of seta D-2 equidistant from D-1 and SD-2; rib 2 and, occasionally, rib 3 of mandible terminates in a process before reaching cutting margin; raduloid on hypopharynx with 12 ridges.

Type.—A male syntype of *egena* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "Type, *P. egena* Gn., a/c Hofer/*egena*, Bresil/Ex Musaeo, Ach. Guenee/Oberthur Collection/Barnes Collection."

Type locality.—Brazil.

Host plant.—*Agapanthus* sp., *Althaea rosea*, *Apium graveolens*, *Brassica oleracea* varieties, *Chrysanthemum* sp., *C. frutescens*, *Daucus carota*, *Delphinium* sp., *Glycine max*, *Malva* sp., *Mentha* sp., *M. spicata*, *Phaseolus* sp., *P. limensis*, *P. vulgaris*, *Senecio* sp., *Symphytum* sp., *Tagetes erecta*.

Range (map 3).—Florida, New Mexico, and California; south to Brazil.

Comments.—This species is called the bean

leaf skeletonizer. Larvae examined were borrowed from laboratory cultures maintained at the University of California, Riverside.

Rachiplusia Hampson

Generotype.—*Plusia nu* Guenee, 1852, p. 347. Original designation.

Rachiplusia Hampson, 1913, p. 410.

Autographa: McDunnough, 1916, p. 400.

Rachiplusia: McDunnough, 1944, p. 207.

This is another basically Neotropical genus. The generotype occurs in South America, whereas *R. ou* (Guenee) occurs from Venezuela northward and has successfully invaded all but the northernmost areas of the United States. Its success in North America is due mainly to its ability to feed on several common, widespread host plants.

The presence of spines on all tibiae characterizes this genus. On the larvae, the setal pinacula of SV-1 and SV-2 are separated, which is a character state different from that of *Autographa* species.

Rachiplusia ou (Guenee)

Figure 171

Plusia ou Guenee, 1852, p. 348.

Plusia fratella Grote, 1875a, p. 161.—Morrison, 1875, p. 219.

Plusia ou var. *russea* Edwards, 1886, p. 170.

Plusia ou var. *californica* Speyer, 1875, p. 164; Smith, 1893, p. 252.

Autographa ou: Dyar, 1902, p. 81.

Autographa ou: Dyar, 1903, p. 200. [=race of *gamma*]

Phytometra ou: Hampson, 1913, pp. 542, 543.

Autographa ou: McDunnough, 1916, p. 400.

Autographa pedalis (Grote), 1875c, p. 204.—Barnes and McDunnough, 1917, p. 84.

Rachiplusia ou: McDunnough, 1944, p. 207.

Male genitalia (fig. 26).—Vinculum of even width throughout, truncate at apex; juxta produced to a point at apex; valve narrow at base, expanding gradually to truncate apex, with no ampulla; costa and sacculus well defined from base to caudal margin; clavi elongate, filiform,

about one-third length of valve; aedeagus rather thick throughout, slightly expanded at base, with three groups of small cornuti; one group basad with about three cornuti, two groups mesad with three to six cornuti in each group.

Female genitalia (fig. 97).—Ostium bursae broad, dorsoventrally compressed, sclerotized, with longitudinal grooves dorsally and ventrally, bilobed caudoventrad, tapered slightly to base; initial short section of ductus bursae membranous, narrow, leading to a short, well-defined sclerotized section, becoming membranous until it widens and becomes strigate and partially sclerotized, entering the corpus bursae on the right side; corpus bursae constricted cephalad, producing a small, well-defined fundus; cephalic one-half shagreened and membranous, caudal one-half strigate and partially sclerotized with apical region bent to the right dorsad of ductus bursae; ductus seminalis arises from sclerotized bulge on cephalic side of apical region ventrad.

Larvae.—No vestige of prolegs present on abdominal segments 3 and 4; integument with dark microspines particularly on venter and around base of pinaculum of seta SD-2, the amount of spination is highly variable; crochets range from 20 to 22 in number; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; pinacula of seta SV-1 and SV-2 separated on abdominal segment 2; pinacula of the two V-1 setae about the same distance from each other as V-1 is from SV-2 on abdominal segment 4; dark lateral band on head if present, not including ocelli 1-4 on all specimens examined; ribs of mandibles without processes, continuing to cutting margin; raduloid on hypopharynx with 10 ridges.

Type.—Syntypes, not seen by us, British Museum (Natural History) (*ou*). British Museum (Natural History) (*pedalis*). Syntypes, not seen by us, British Museum (Natural History) (*fratella*).

Type locality.—Boreal America (*ou*). Kansas (*pedalis*). Texas (*fratella*).

Host plant.—*Chenopodium ambrosioides*, *Cosmos* sp., *Nicotiana tabacum*, *Trifolium* sp., Crumb (1956); *Mentha* sp., Tietz (1972); *Triticum*

aestivum, *Tropaeolum* sp., Eichlin and Cunningham (1969).

Range (map 3).—United States except northernmost States.

Comments.—Parental females of laboratory cultures were collected from a light trap at Auburn, Ala., and, in addition, numerous specimens were examined from field collections.

Plusia Ochsenheimer

Generotype.—*Noctua chrysitis* Linnaeus, 1758. Designated by Duponchel, 1829, p. 71.

Plusia Ochsenheimer, 1816, p. 89.

Agrapha Hübner, [1821], p. 250 (*partim*).

Plusia: Dyar, 1902, p. 81.

Phytometra: Hampson (*nec* Haworth), 1913, p. 452.

Plusia: McDunnough, 1916, p. 400.

One species represents this genus in North America. There is no stigma or other silvering on the forewing as with most plusiines. *Plusia* is a genus of northern temperate regions, and is essentially a Palearctic genus.

Plusia balluca (Geyer)

Figure 172

Dyachrysis balluca Geyer, 1832, p. 2, figs. 681, 682.

Plusia balluca: Guenee, 1852, p. 344.

Phytometra balluca: Hampson, 1913, p. 577.

Plusia balluca: McDunnough, 1916, p. 400.

Male genitalia (fig. 29).—Uncus long and thick; tegumen wide; vinculum elongate, narrowed apically to a point; juxta with large, sclerotized projection ventrad; valve broad with rounded apex, clavi filiform, ampulla narrowed abruptly at distal one-fourth, extended to costal margin; aedeagus with basal cornutus, and median cluster of a few small cornuti.

Female genitalia (fig. 94).—Lateral invaginations of abdominal segment 8 forming deep pockets; ductus bursae thick, sclerotized, strigate, with a spiculate sac on right side on cephalic one-half, ductus bursae entering bursa copulatrix on right side; corpus bursae elongate, membranous, spiculate at apex; ductus seminalis arises from apex of corpus bursae.

Larvae.—No vestige of prolegs on abdominal segments 3 and 4; integument without microspines; crochets range from 18 to 20 in number; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; abdominal segment 2 with pinacula of setae SV-1, SV-2, and V-1 approximately equidistant from each other, widely separated; abdominal segment 4 with pinacula of two V-1 setae about one-half the distance from each other as V-1 is from SV-2; on mesothorax pinaculum of D-2 closer to D-1 than to SD-2; ribs 2 and 3 of mandible terminating in processes before reaching cutting margin; raduloid absent on hypopharynx.

Type.—British Museum (Natural History).

Type locality.—Georgia.

Host plant.—*Humulus lupulus*, Tietz (1972); *Populus tremuloides*.

Range (map 7).—Nova Scotia to Manitoba; south to Pennsylvania and Minnesota (no specimens seen from Southeastern United States).

Allagrapha Franclemont

Generotype.—*Noctua aerea* Hübner, [1800–1803], pl. 56, fig. 27. Original designation.

Allagrapha Franclemont, 1964, p. 73.

Plusia: Ichinose, 1973, p. 139, (*Agrapha* Hüb.).

Like the North American species of *Plusia*, the species of *Allagrapha* lack the metallic silver or gold signs on the forewings. The male genitalia characteristically have a highly modified sacculus with a heavily sclerotized and specialized apex. The larvae are basically like those of *Plusia*, but have a hypopharyngeal raduloid, whereas the latter does not.

McDunnough (1944) and Franclemont (1964) agreed that *A. aerea* (Hüb.) differed significantly in characters of the male genitalia from the generotype of *Plusia*, *P. chrysitis* L., to remove the former from *Plusia*. Recently, Crumb (1956), Kostrowicki (1971), and Ichinose (1973) regarded *Agrapha* (= *Allagrapha*) as a synonym of *Plusia* on the basis that the splitting of the genus tended to obscure the relationships among the species of this group. Ichinose argues that the differences of the male genitalia are not significant enough in themselves and cites the similarities in female genitalia and larval morphol-

ogy as reasons for not splitting *aerea* from *Plusia*.

Undoubtedly, the species involved are all closely related; however, *A. aerea* and *A. aeroides* are similar to each other in adult and larval features, with a strong superficial appearance which cannot be ignored. In addition, the two differ from species of *Plusia* in the modifications of the male genitalia and the presence of a raduloid on the larvae of *Allagrapha*, a raduloid being absent at least on the Nearctic *Plusia* species. For these reasons, the authors feel it is useful to separate *aerea* and *aeroides* from *Plusia* to demonstrate better their close relationship to each other and distinctiveness from other *Plusiinae*. There are apparently no comparable Palearctic species.

KEY TO THE SPECIES BASED ON MALE GENITALIA

- Aedeagus with sclerotized apical plate; saccus longer than one-half length of valve (fig. 35) *aerea*
 Aedeagus without sclerotized apical plate; saccus shorter than one-half length of valve (fig. 33)
 *aeroides*

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

- Ostium bursae large, mostly sclerotized; corpus bursae with elongate apical region (fig. 104) ... *aeroides*
 Ostium bursae poorly defined, mostly membranous; corpus bursae saclike, lacking definite apical region (fig. 98) *aerea*

Allagrapha aeroides (Grote), new combination

Figure 173

Plusia aeroides Grote, 1864, p. 83.

Phytometra aeroides: Hampson, 1913, p. 572.

Plusia aeroides: McDunnough, 1916, p. 400.

Male genitalia (fig. 33).—Vinculum pointed; valve approximately of same width throughout, though slightly narrowed at round apex; clavus filiform; ampulla broad, heavily sclerotized, bladeliike, extending dorsocaudad to costal margin; aedeagus without cornuti, spiculate at apex.

Female genitalia (fig. 104).—Ostium bursae large, round, dorsoventrally flattened, sclerotized ventrally and laterally, infolded subdorsally, membranous dorsad; ductus bursae less than one-half as wide as ostium bursae, entirely membranous, somewhat strigate, forming a

loop projecting dorsad before entering corpus bursae on right side; corpus bursae membranous, cephalic one-half saclike, bent to the left, caudal one-half more narrow with apex ventrad of ductus bursae; ductus seminalis arises from apex of corpus bursae.

Larvae.—No vestige of prolegs on abdominal segments 3 and 4; integument without microspines; crochets range from 17 to 20 in number; seta SV-2 absent on meso- and metathorax; seta SV-2 absent on abdominal segment 1; abdominal segment 2 with pinaculum of seta SV-1 approximately equidistant from SV-2 and V-1, widely separated; abdominal segment 4 with pinacula of two V-1 setae about one-half the distance from each other as V-1 is from SV-2; on mesothorax pinaculum of D-2 closer to D-1 than to SD-2; ribs 2 and 3 of mandible terminating in processes before reaching cutting margin; raduloid on hypopharynx with 12 ridges.

Type.—[?] British Museum (Natural History).

Type locality.—Massachusetts, New York, Pennsylvania.

Host plant.—*Mentha arvensis*, Crumb (1956); *Spiraea salicifolia*, Tietz (1972); *Aster* sp., Forbes (1954).

Range (map 7).—Nova Scotia to British Columbia; south to Pennsylvania in the east and the Colorado and California in the west.

Comments.—Larvae of this species were reared on artificial medium. The parental females were collected in Groveton, N.H., at a black light.

Allagrapha aerea (Hübner)

Figure 174

Noctua aerea Hübner, [1800–1803], pl. 56, fig. 27.

Agrapha aerea: Hübner, 1821, p. 251.

Plusia aerea: Boisduval, 1829, p. 59.

Phytometra aerea: Hampson, 1913, p. 575.

Autographa aerea: McDunnough, 1916, p. 400.

Agrapha aerea: McDunnough, 1944, p. 216.

Allagrapha aerea: Franclemont, 1964, p. 73.

Male genitalia (fig. 35).—Uncus thin; tegumen very short; juxta small, somewhat circular with a thick, stubby spine ventrad; vinculum long, tapered to a blunt point; valves highly modified,

sacculus heavily sclerotized, expanded on dorsal edge into a rounded plate, and extending ventrocaudad, forming a sharp, upcurved projection near middle of valve; ampulla wide, large, heavily sclerotized, curved caudad, with projection cephalad of midpoint; clavus expanded at apex, setose; aedeagus with a sclerotized apical plate, usually having three strong spines on its ventral edge and one spine on caudal edge.

Female genitalia (fig. 98).—Ostium bursae mostly membranous, poorly defined; ductus bursae short, U-shaped from lateral aspect, partially sclerotized, strigate where it enters apex of corpus bursae on left side very near origin of ductus seminalis; corpus bursae membranous, saclike with no well defined fundus or apical region.

Larvae.—Very similar to *A. aeroides*, see following description of that species; crochets range from 19 to 21 in number; abdominal segment 2 with pinaculum of seta SV-1 closer to SV-2 than to V-1; and raduloid on hypopharynx with 18 ridges.

Type.—[?].

Type locality.—[?].

Host plant.—General feeder on low plants, Forbes (1954); *Urtica* sp., Crumb (1956); *Aster umbellatus*, *Glycine max*.

Range (map 2).—Nova Scotia to Alberta; south to New Mexico and Gulf of Mexico.

Comments.—Parental females of laboratory cultures were collected from a light trap at Auburn, Ala. Other material was reared from adults collected near Pittsburgh, Pa.

Polychrysia Hübner

Generotype.—*Noctua moneta* Fabricius, 1787, p. 162. Monobasic.

Polychrysia Hübner, 1821, p. 251.

Chrysoptera Latreille, 1825, p. 476.

Deva: Smith, 1893, p. 246, (*partim*).

Polychrysia: Dyar, 1902, p. 80.

Chrysoptera: Hampson, 1913, p. 439.

Polychrysia: McDunnough, 1944, p. 212.

Polychrysia is a Holarctic group with two species in the Nearctic region. This genus is apparently related to *Adeva* McDunnough and

Pseudeva Hampson, but further verification is needed through a comparison of the immatures, which are unknown or not available at this time.

KEY TO THE SPECIES BASED ON MALE GENITALIA

- Valves oval, broadly rounded at apices; small pointed process on valve near base of ampulla (fig. 37a)
..... *morigera*
- Valves not oval, tapering somewhat toward apices; no process on valve near base of ampulla (fig. 36a)
..... *moneta*

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

- Corpus bursae saclike, apex broadly rounded (fig. 108)
..... *morigera*
- Corpus bursae narrow, tapering at both ends, somewhat S-shaped from dorsal aspect (fig. 110)
..... *moneta*

Polychrysia moneta (Fabricius)

Figure 175

Noctua moneta Fabricius, 1787, p. 162.

Phalaena-Noctua moneta: Gmelin, 1789, p. 2556.

Polychrysia moneta: Hübner, 1821, p. 251.

Plusia moneta: Treitschke, 1823, p. 158.

Chrysoptera moneta: Latreille, 1825, p. 476.

Polychrysia trabea (Smith), 1895, p. 340, p. 15, fig. 16,—Dyar, 1903, p. 198.

Polychrysia moneta: Dyar, 1902, p. 80.

Chrysoptera moneta: Hampson, 1913, pp. 444, 445.

Polychrysia moneta: McDunnough, 1944, p. 212.

Male genitalia (fig. 36).—Very similar to the following species, *morigera*, but with valve slightly tapered toward apex, ampulla longer, arising more ventrad, and clavus more elongate; apex of aedeagus not spinose in those specimens examined.

Female genitalia (fig. 110).—Ostium bursae short, broad, round, mostly membranous; ductus bursae strigate, sclerotized, expanded gradually to entrance into corpus bursae on left side; corpus bursae elongate, tapered at both ends and somewhat S-shaped from dorsal aspect; ductus seminalis arises from apex of corpus bursae.

Type.—Lost (Zimsen, 1964) (*moneta*). Male, National Museum of Natural History (*trabea*).

Type locality.—Austrian mountains (*moneta*). Calgary, Alberta (*trabea*).

Host plant.—*Delphinium* sp., Crumb (1956). In Europe, it feeds on many species of *Aconitum*, *Cucumis*, *Delphinium*, *Helianthis*, and *Trollius* (Kostrowicki, 1961).

Range (map 14).—Ontario to Alberta; north to Alaska; Europe.

Polychrysia morigera (Edwards)

Figure 176

Deva morigera Edwards, 1886, p. 169.

Panchrysia morigera: Dyar, 1902, p. 81.

Chrysoptera morigera: Hampson, 1913, pp. 445, 446.

Polychrysia morigera: McDunnough, 1944, p. 212.

Male genitalia (fig. 37).—Overall size small, similar to *Adeva albavitta*; valve oblong, rounded at apex; clavus more developed than in *albavitta*; ampulla slender, elongate, projecting just beyond costal margin; no point on juxta; aedeagus with apex spinose, and with a slender apical cornutus.

Female genitalia (fig. 108).—Ostium bursae mostly membranous; ductus bursae with initial one-third membranous, expanded dorsad abruptly to three times its initial width, sclerotized, strigate, doubling width on final one-third, entering corpus bursae on the left side very near apex of corpus bursae; corpus bursae broad at apex and with a bluntly pointed fundus.

Larvae.—No vestige of prolegs on abdominal segments 3 and 4; minute microspines on integument; all pinacula of setae on head ringed with black; crochets range from 21 to 23 in number; seta SV-2 absent on meso- and meta-thorax; pinacula of setae SV-1 and SV-2 at least partially fused on abdominal segment 2; abdominal segment 4 with pinacula on setae V-1 closer than to SV-2; on mesothorax pinaculum of seta D-2 equidistant from D-1 and SD-2; only rib 2 of mandible terminating in a process before reaching cutting margin; raduloid of hypopharynx absent.

Type.—Female, American Museum of Natural History.

Type locality.—Colorado.

Host plant.—*Delphinium* sp.

Range (map 7).—Oregon, Wyoming, Montana, California, and Colorado.

Comments.—Larvae and associated parental female were borrowed from the McFarland Collection at the Los Angeles County Museum of Natural History, Calif. Adult specimens agreed with type examined in the American Museum of Natural History.

Adeva McDunnough

Generotype.—*Autographa albavitta* Ottolengui, 1902, p. 75. Original designation. *Adeva* McDunnough, 1944, p. 213.

Adeva is a monobasic genus closely allied to *Pseudeva*, based on genitalic structures. The most obvious feature which the two genera have in common is the very reduced clavus of the males. The larvae of both groups are as yet unknown. The only species in the genus occurs in the high deserts and mountains of southwestern United States. Its biology is unknown.

Adeva albavitta (Ottolengui)

Figure 177

Autographa albavitta Ottolengui, 1902, p. 75.

Phytometra hutsonii (Smith), 1904, p. 60—Hampson, 1913, p. 570.

Autographa albavitta: McDunnough, 1916, p. 400.

Adeva albavitta: McDunnough, 1944, pp. 213, 214.

Male genitalia (fig. 32).—Overall size small, compact; uncus thick with apical spine; tegumen short and wide; juxta produced into a long point at apex; valves short, oblong; ampulla arises approximately in center of valve, elongate, slender, extending just beyond costal margin; clavus reduced to a setose knob; vinculum short, tapered to a point apically; aedeagus longer than valve, with short basal cornutus, with a circular base.

Female genitalia (fig. 106).—Ostium bursae undifferentiated from ductus bursae, which is membranous and very narrow on caudal one-half, becoming lightly sclerotized and strigate, and widening to about four times its initial width as it enters the corpus bursae on the

right side; corpus bursae somewhat laterally compressed, at least when spermatophore is present, broadest just caudad of middle, cephalic one-half narrower and elongate; ductus seminalis arises from apex of corpus bursae.

Type.—Female, National Museum of Natural History (*albavitta*). Lectotype male, American Museum of Natural History (*hutsonii*) designated by Todd (1972).

Type.—Middle California (*albavitta*). Yuma Co., Ariz. (*hutsonii*).

Host plant.—Unknown.

Range (map 3).—Oregon, California, Arizona, and Nevada.

Pseudeva Hampson

Generotype.—*Deva purpurigera* Walker, 1858, p. 1791. Original designation. *Pseudeva* Hampson, 1913, p. 447.

This genus is apparently restricted to temperate North America. The adult morphology suggests a close relationship to *Adeva* and probably *Polychrysis*. These three genera all have relatively small and compact male genitalia similar in general form. In *Polychrysis*, the clavi is short, but is reduced to a small swelling in *Adeva* and *Polychrysis*. The female genitalia differ sufficiently to distinguish the species, but also demonstrate the relative closeness of the above three genera in general features. Once associated with their adult forms, the larvae of species in the three genera when compared will probably verify the proposed relationships.

KEY TO THE SPECIES BASED ON MALE GENITALIA

- Aedeagus with a curved, sclerotized plate apically, to which are attached several small spines (fig. 31) *palligera*
- Aedeagus with 20 to 25 stout, sharp, sclerotized spines apically, joined together at their bases forming a row, longer than the spines of the above species, the longest being about one-third the width of aedeagus (fig. 27) *purpurigera*

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

- On specimens examined, corpus bursae slightly different in shape from the other species, having not only a well-defined apical region, but an additional lobe to the left of apex (fig. 100) *palligera*

Very similar to above species, but apparently without the additional lobe caudad on left side of corpus bursae (fig. 101) *purpurigera*

Pseudeva palligera (Grote)

Figure 178

Deva palligera Grote, 1881, p. 35.

Panchrysis palligera: Dyar, 1902, p. 80.

Pseudeva palligera: Hampson, 1913, p. 449.

Pseudeva rubigera Hampson, 1913, p. 449 (new synonymy).

Male genitalia (fig. 31).—Overall size small, generally like males of *Polychrysis* spp., vinculum short and pointed; juxta simple, not pointed or spined; valves short, wide and rounded apically, with ampulla arising approximately in center of valve midway from base to apex, and extending a little beyond costal margin; clavi reduced to a mere setose knob; aedeagus with median, small cornutus, and a curved, sclerotized, spinose plate at apex.

Female genitalia (fig. 100).—Ostium protected by folds of tissue from abdominal segment 8; ostium bursae membranous; ductus bursae granulose, strigate, entering corpus bursae on the left side; corpus bursae granulose, with pointed lobe caudad on left side on all specimens examined; ductus seminalis arises from granulose apex.

Type.—A male syntype of *palligera* in the American Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "*Deva palligera* Gr., Type/3511, Sierra Nev., Cal./No. 11226, Collection Hy. Edwards." Male, British Museum (Natural History) (*rubigera*).

Type locality.—Sierra Nevada, Calif. (*palligera*). California (*rubigera*).

Host plant.—Unknown.

Range (map 8).—California, Montana, Idaho, and Colorado.

Comments.—We could find no difference between *palligera* and *rubigera* in the genitalia and consider any small differences in wing pattern to be in the expected range of species variation.

Pseudeva purpurigera (Walker)

Figure 179

Deva purpurigera Walker, 1858, p. 1791.

Plusia purpurigera: Grote, 1874a, p. 30.

Deva purpurigera: Grote, 1881, p. 35.

Panchrysia purpurigera: Dyar, 1902, p. 80.

Pseudeva purpurigera: Hampson, 1913, pp. 448, 449.

Male genitalia (fig. 27).—Very similar to *palligera* except aedeagus with a patch of many small cornuti apically.

Female genitalia (fig. 101).—Ostium protected above and below by folds of punctate, mostly membranous tissue of abdominal segment 8; ostium bursae entirely membranous; ductus bursae granulose throughout, only sclerotized initially, then broadening and membranous, elbowed to the left before entering corpus bursae on the left side; corpus bursae granulose with ductus seminalis arising from apex.

Type.—British Museum (Natural History).

Type locality.—Orilla [Ontario], Canada.

Host plant.—*Thalictrum* sp., Tietz (1972).

Range (map 8).—Nova Scotia to Manitoba; south to Delaware, west to Montana, then south to New Mexico.

Chrysanympa Grote

Generotype.—*Leptina formosa* Grote, 1865, p. 323. Monobasic.

Chrysanympa Grote, 1895a, p. 417.

Abrostola, Hampson (*nec* Haworth), 1913, p. 582, (*partim*).

Chrysanympa: McDunnough, 1944, p. 211.

Chrysanympa is represented by a single species. It is unique in its superficial appearance. The male genitalia are generally like species of *Autographa*. Its phylogenetic position cannot be accurately determined, pending examination of the larva.

Chrysanympa formosa (Grote)

Figure 180

Leptina formosa Grote, 1865, p. 323.

Plusia formosa: Morrison, 1875, p. 98.

Polychrysia formosa: Dyar, 1902, p. 79.

Abrostola formosa: Hampson, 1913, pp. 583, 584.

Chrysanympa formosa: McDunnough, 1938, p. 114.

Male genitalia (fig. 40).—Overall size small, uncus long and slender, juxta narrow, tapered to a down-curved point; valve wide, slightly rounded apically, ampulla slender, just reaching costal margin, clavus slender and about as long as one-half the median width of valve; vinculum narrowed apically to a blunt point; aedeagus with club-shaped, basal cornutus.

Female genitalia (fig. 111).—Ostium bursae short, broad, sclerotized and strigate; ductus bursae short, straight, initially membranous, then strigate, entering corpus bursae into an elongate, granulate pouch on left side; corpus bursae elongate, narrow, fundus recurved to the left, projecting caudad; ductus seminalis arises from narrow apex.

Type.—[?] Museum of Comparative Zoology, Harvard University.

Type locality.—Lawrence, Mass.

Host plant.—*Gaylussacia dumosa*, *Vaccinium* sp., Tietz (1972).

Range (map 4).—Nova Scotia to Manitoba; south to Michigan and North Carolina.

Eosphoropteryx Dyar

Generotype.—*Plusia thyatyroides* Guenee, 1852, p. 337. Monobasic.

Eosphoropteryx Dyar, 1902, p. 80.

As with the preceding genus, *Eosphoropteryx* contains a unique species. Its placement in relation to the other species is highly tenuous. Hopefully, an examination of the immatures will eventually clarify the problem. This genus and *Chrysanympa* are native to the Nearctic fauna.

Eosphoropteryx thyatyroides (Guenee)

Figure 181

Plusia thyatyroides Guenee, 1852, p. 337.

Eosphoropteryx thyatyroides: Dyar, 1902, p. 80.

Male genitalia (fig. 41).—Uncus long and slender; tegumen short and broad; valve narrow at apex, very wide medially, bulging ventrad; ampulla small, short; clavus long, slender; vinculum tapered to a point; aedeagus without cornuti, vesica somewhat spiculate.

Female genitalia (fig. 103).—Ostium bursae twice as long as wide, rectangular, flattened caudad, with venter evenly sclerotized and dorsum membranous, ventrocaudal edge turned downward; ductus bursae about as long as ostium bursae and narrower, somewhat sclerotized and weakly strigate, bending to the right, and entering corpus bursae on left side beyond apex, corpus bursae oblong, with apex straight, rugose, irregularly pigmented; ductus seminalis arises from apex of corpus bursae.

Syntypes.—Barnes Collection in the National Museum of Natural History and the British Museum (Natural History).

Type locality.—New York.

Host plant.—*Thalictrum* sp., Forbes (1954).

Range (map 4).—Nova Scotia to British Columbia; south to Virginia, Minnesota, and Oregon.

Autographa Hübner

Generotype.—*Noctua gamma* Linnaeus, 1758, p. 513. Designated by Grote, 1895b, p. 61.

Autographa Hübner, 1821, p. 251.

Phytometra Hampson (*nec* Haworth), 1913, p. 452, (*partim*).

Autographa: McDunnough, 1916, p. 400.

The species of this genus can be separated for the most part by cursory examination of the wing patterns and colors (refer to Forbes, 1954, pp. 298–308, and photographs provided here). The genitalia by contrast, particularly of the males, are similar to each other.

The male genitalia are characterized by having long, filiform clavi, setose on the apex. The tegumen is lengthened and the valves are long and broad with only a few exceptions. The sacculus of the valve is expanded and somewhat keeled ventrally. The ampulla is generally slender and extends to the costal margin at least and beyond in most species. The vinculum is relatively long and bluntly pointed. The aedeagus is long, slender for most of its length, and bulbous at the base, which has a single cornutus with an extended, flat, sclerotized, basal plate in most species. The juxta is typically produced to a blunt point apically, but not into a spinelike process. Males of *corusca*, *labrosa*, and *speciosa* cannot be separated with

certainty on the basis of genitalic characters examined in this study.

The female genitalia are also relatively homogenous, but enough features permit differentiation. In general, the ostium bursae is short with no caudal extensions, thus leaving the ostium unprotected. The ductus bursae is most often a slender, heavily strigate tube, having a short lateral process near the base of the ostium bursae in several species. In all but three of the species, the ductus bursae enters the corpus bursae on the right side. The corpus bursae is large and saclike, but varies in shape among species. Most species have a rounded, semilunate protuberance or otherwise tough, thickened area on the corpus bursae cephalad of the entrance of the ductus bursae. The ductus seminalis arises from the apex of the corpus bursae in most species.

The larvae of the genus *Autographa* have no vestige of prolegs on abdominal segments 3 and 4. Pinacula of SV-1 and SV-2 are partially fused on abdominal segments 2–4. SV-2 is absent on abdominal segment 1, and SV-2 is absent on the meso- and metathorax on all species. The two V-1 setae on abdominal segment 4 are usually closer to each other on most species than V-1 is to SV-2. The presence of a raduloid is a constant feature, with the number of ridges, though stable in number for individual species, ranging from 8 on the generotype, *gamma*, to 18 on *ampla*.

KEY TO THE SPECIES BASED ON MALE GENITALIA

1. Length of tegumen greater than one-half of the length of the valve 2
 Length of tegumen one-half or less than one-half the length of valve 7
2. Aedeagus with cornutus 3
 Aedeagus without cornutus (fig. 45) *biloba*
3. Length of aedeagus about six times the length of cornutus (fig. 52) *v. alba*
 Length of aedeagus about five times the length of cornutus (fig. 46) *speciosa* (fig. 48) *corusca* (fig. 50) *labrosa*
 Length of aedeagus about four times length of cornutus 4
4. Ratio of length of tegumen to length of valve about 3:5 (fig. 55) *ample*
 Ratio of length of tegumen to length of valve slightly more than 1:2 (fig. 42) 5
5. Caudal end of valve narrowed and strongly upturned (fig. 43) 6

- Caudal end of valve rounded and slightly upturned (fig. 42) *mappa*
6. Clavus about as long as width of valve from base of clavus to ventral margin (fig. 43) . *bimaculata*
Clavus longer than width of valve from base of clavus to ventral margin (fig. 47) ... *flagellum*
7. Length of valve about three times the length of tegumen (fig. 49) *precatiosis*
Length of valve about two times the length of tegumen (fig. 56) 8
8. Aedeagus with small patch of about 8 to 10 tiny cornuti apically and one large cornutus basally (fig. 56) *rubida*
Aedeagus with one basal cornutus only 9
9. Length of aedeagus at most four times length of cornutus 10
Length of aedeagus at least five times length of cornutus 11
10. Length of aedeagus about three times length of cornutus; costal margin of valve slightly upturned (fig. 54) *sansoni*
Length of aedeagus about four times length of cornutus; costal margin of valve straight (fig. 44) *pasiphaeia*
11. Length of aedeagus about five times length of cornutus (fig. 53) *californica*
Length of aedeagus about six times length of cornutus (fig. 51) *metallica*
Length of aedeagus about seven times length of cornutus (fig. 57b) *pseudogamma*

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

1. Entrance of ductus bursae on left side 2
Entrance of ductus bursae on right side 4
2. Apex of corpus bursae strigate and sclerotized (fig. 112) *precatiosis*
Apex of corpus bursae clear or merely granulose, or if weakly strigate, not sclerotized (fig. 115) . 3
3. Corpus bursae constricted in middle (fig. 113) *californica*
Corpus bursae not constricted in middle (fig. 115) *biloba*
4. Saclike protuberance or much thickened area cephalad of ductus bursae entrance into corpus bursae (fig. 114) 5
No saclike protuberance or thickened area on corpus bursae 13
5. Ductus bursae with a sclerotized, strigated appendage near base of ostium bursae (fig. 114) .. 6
No appendage on ductus bursae near base of ostium bursae 8
6. Saclike protuberance on corpus bursae with tubular structures internally (fig. 121) 7
Saclike protuberance on corpus bursae without tubular structures internally (fig. 114) *ampla*
7. Caudal one-half of corpus bursae, including apex, strigate (fig. 121) *labrosa*

- Caudal one-half of corpus bursae not strigate except perhaps on right side near entrance of ductus bursae (fig. 118) *corusca*
8. Ductus bursae simple, strigate, approximately same width throughout 9
Cephalic one-half of ductus bursae at least twice as wide as caudal one-half (fig. 119) ... *flagellum*
9. Corpus bursae strongly recurved to the right, either at the middle (fig. 117) or apical region (fig. 122) 10
Corpus bursae not recurved to the right 11
10. Apex of corpus bursae recurved to the right; main portion of corpus bursae disk shaped (fig. 122) *rubida*
Corpus bursae recurved at the middle, U-shaped (fig. 117) *sansoni*
11. Corpus bursae with pigmented protuberance cephalad of entrance of ductus bursae (fig. 123) 12
Corpus bursae without a protuberance but with a much thickened region cephalad of ductus bursae entrance; ostium bursae longer than wide (fig. 120) *mappa*
12. Ostium bursae about as long as wide in ventral aspect (fig. 131) *v-alba*
Ostium bursae small, not as long as wide in ventral aspect (fig. 123) *pasiphaeia*
13. Caudal end of ductus bursae with lateral appendage (fig. 134) 14
Caudal end of ductus bursae without lateral appendage (fig. 132) *speciosa*
14. Main portion of corpus bursae disk shaped; elongated apical region appressed to side of corpus bursae (fig. 134) *metallica*
Corpus bursae not shaped as above 15
15. Ductus bursae smoothly strigate for most of its length (fig. 116) *pseudogamma*
Ductus bursae not smoothly strigate for most of its length, strigae rugosissimus (fig. 125) *bimaculata*

Autographa precatiosis (Guenee)

Figure 182

Plusia precatiosis Guenee, 1852, p. 344.

Autographa precatiosis: Dyar, 1902, p. 81.

Phytometra precatiosis: Hampson, 1913, pp. 524, 525.

Autographa precatiosis: McDunnough, 1916, p. 400.

Male genitalia (fig. 49).—Valve narrow, elongate, of equal width for most of its length, apex narrower than median width and rounded; ampulla typical, but arising basad of center of valve about one-third of the total length of valve from the base; aedeagus basally with

many minute spines on vesica; other structures typical of the genus.

Female genitalia (fig. 112).—Ostium bursae about as wide as it is long; ductus bursae membranous for caudal one-third, then pigmented and sclerotized to entrance into corpus bursae, which is near the meson, dorsad but slightly toward the left, where it becomes heavily strigate, corpus bursae long and narrow, curved dorsad toward cephalic one-half; apex of corpus bursae complex, with a sclerotized and strigate lobe projecting dorsally on left side and a membranous bulge on the right side, with the ductus seminalis arising on that narrow, membranous, caudal portion produced below and slightly to the right of the ductus bursae.

Larvae.—Integument with at least a subdorsal band of microspines, which includes pinacula of setae SD-2 of abdominal segments; ribs of mandible terminating in processes, not extending to cutting margin; crochets range from 21 to 23 in number; rabuloid of hypopharynx with 16 ridges; otherwise typical for genus.

Type.—Syntypes not seen by us, British Museum (Natural History), National Museum of Natural History.

Type locality.—North America.

Host plant.—*Althea rosea*, *Aureolaria pedicularia*, *Carduus* sp., *Helianthus* sp., *Lactuca* sp., *Pastinaca sativa*, *Phaseolus* sp., *Plantago* sp., *Taraxacum officinale*, Crumb (1956); *Arctium lappa*, *Brassica oleracea*, *Chenopodium album*, *Cirsium* sp., *Ipomoea purpurea*, Tietz (1972); *Verbena* sp.

Range (map 5).—Nova Scotia to Ontario; south to Georgia; west to Wisconsin, and Kansas.

Comments.—Laboratory cultures were initiated from females captured in Auburn, Ala.; Lincoln, Me.; East Lansing, Mich.; and Shawano, Wis.

Autographa bimaculata (Stephens)

Figure 183

Plusia bimaculata Stephens, 1832, p. 102.

Plusia u-brevis Guenee, 1852, p. 341.—Walker 1857, p. 905.

Plusia bimaculata: Grote, 1874b, p. 72.

Autographa bimaculata: Dyar, 1902, p. 81.

Phytometra bimaculata: Hampson, 1913, pp. 530, 531.

Autographa bimaculata: McDunnough, 1916, p. 400.

Male genitalia (fig. 43).—Valve with apex somewhat narrowed to a blunt point and upturned; otherwise typical of genus. Refer to descriptions of the genus and key to species.

Female genitalia (fig. 125).—Ostium bursae about as wide as long, dorsoventrally flattened, and weakly sclerotized; ductus bursae initially membranous, rugosissimus strigae, with caudal projection to the right, and sinuous, making a dorsal loop like an upside-down U before entering the corpus bursae on the right side; corpus bursae without protuberance or thickened area, strigate, membranous throughout, expanded cephalad, somewhat laterally compressed and bent both ventrad and laterad toward the right; ductus siminalis arises from the apex, which is narrowed and rounded.

Larvae.—Integument without microspines; mandible with ribs 2 and 3 terminating in processes, not extending to cutting margin; head without black, lateral stripe; raduloid of hypopharynx with 15 ridges, otherwise typical for the genus.

Type.—[?] British Museum (Natural History) (*bimaculata*). Syntypes, Barnes Collection in the National Museum of Natural History and British Museum (Natural History) (*u-brevis*).

Type locality.—[?] (*bimaculata*). New York (*u-brevis*).

Host plant.—*Taraxacum officinale*, Tietz (1972).

Range (map 18).—Nova Scotia to British Columbia; south to New Jersey in the east and to New Mexico in the west.

Comments.—Parental females of laboratory cultures were collected at black lights in Stratford, Coos County, N. H., and Mare du Sault Camp, Laurentides Park, Quebec.

Autographa sansoni Dod

Figure 184

Autographa sansoni Dod, 1910, p. 349.

Phytometra sansoni: Hampson, 1913, pp. 546, 547.

Autographa sansoni: McDunnough, 1916, p. 400.

Male genitalia (fig. 54).—Typical, refer to description of the genus and the key to species.

Female genitalia (fig. 117).—Ostium bursae wide, only lightly sclerotized; ductus bursae typical and without appendage near base of ostium bursae, entrance to corpus bursae on the right side; corpus bursae elongate, bent at middle, with apex and fundus coming close together to the right; a large, darkly pigmented, protuberance dorsad on corpus bursae near entrance of ductus bursae.

Type.—Male, National Museum of Natural History.

Type locality.—Banff, Alberta.

Host plant.—Unknown.

Range (map 15).—Alaska, British Columbia, Alberta, Montana, Wyoming, Oregon.

Comments.—Forbes (1954) mentioned an isolated record from Quebec. The specimens studied agreed with the type examined in the National Museum of Natural History.

Autographa rubida Ottolengui

Figure 185

Autographa rubida Ottolengui, 1902, p. 67.

Phytometra rubida: Hampson, 1913, pp. 491, 492.

Autographa rubida: McDunnough, 1916, p. 400.

Male genitalia (fig. 56).—Valve elongate, narrower than is typical of the genus and curves gradually dorsad to the apex; aedeagus with patch of small cornuti near apex on vesica; otherwise typical of the genus, refer to generic description.

Female genitalia (fig. 122).—Ostium bursae typical; ductus bursae membranous and unpigmented except for that portion at entrance to corpus bursae, which is on the right side just cephalad of the apex; the main body of the corpus bursae is disk shaped, with the apical region narrowed abruptly and curved to the right; dorsad to the right and cephalad of the ductus bursae entrance is a circular, thickened, darkly pigmented, rugose area.

Larvae.—Integument with microspines; abdominal segment 1 with SV-2 absent; two V-1 setae on abdominal segment 4 as far apart from each other as each V-1 seta is from SV-2; head black except for two median light stripes; rib 2 of mandible with a sharp, raised ridge; general larval ground is green overlaid with brown

with contrasting light pinacula and light spiracular stripe; legs black; crochets range from 20 to 24 in number; raduloid of hypopharynx with 17 ridges.

Type.—Female, American Museum of Natural History.

Type locality.—Winnipeg, Manitoba.

Host plant.—Unknown.

Range (map 5).—Nova Scotia to Alberta; south to Pennsylvania and west to Illinois.

Comments.—The specimens studied agreed with the type. The larvae examined were from the National Museum of Natural History.

Autographa biloba (Stephens)

Figure 186

Plusia biloba Stephens, 1832, p. 104.

Autographa biloba: Dyar, 1902, p. 81.

Phytometra biloba: Hampson, 1913, pp. 512, 513.

Autographa biloba: McDunnough, 1916, p. 400.

Male genitalia (fig. 45).—Ampulla on valve short, not reaching costal margin; aedeagus without a cornutus; otherwise typical of the genus.

Female genitalia (fig. 115).—Ostium bursae small, weakly strigate and pigmented, membranous basally as is first one-third of ductus bursae; ductus bursae short, straight, strigate, granulose, and weakly sclerotized, entering the corpus bursae at the apex slightly to the left and definitely caudad of the origin of the ductus seminalis; corpus bursae narrow, tapering slightly to the fundus and somewhat hook shaped from a left lateral aspect; fundus membranous but strigate.

Larvae.—Integument with relatively long, conspicuous, dark microspines; head with black lateral stripe including all ocelli in those specimens seen; ribs of mandible extend to the margin with no processes; raduloid on hypopharynx with 13 ridges; crochets range from 20 to 22 in number; otherwise typical for genus.

Type.—British Museum (Natural History).

Type locality.—Unknown.

Host plant.—*Brassica oleracea*, *Medicago sativa*, *Nicotiana tabacum*, Crumb (1956); *Trifolium incarnatum*, Eichlin and Cunningham (1969); *Centaurea solstitialis*, *Cirsium horridulum*, *Helianthus* sp., *Lactuca sativa*, Tietz (1972); *Del-*

phinium sp., *Geranium* sp., *Gladiolus* sp., *Hedra* sp., *Helxine soleirdii*, *Hordeum vulgare*, *Mimulus cardinalis*, *Musa paradisiaca*, *Phacelia* sp., *Phaseolus vulgaris*, *Salvia leucophylla*, *Stachys ajugoides*, *Verbena* sp.

Range (map 18).—Nova Scotia to Manitoba; United States (except Northwest); Neotropics.

Comments.—Parental females of laboratory cultures were collected in light trap at Auburn, Ala.

Autographa californica (Speyer)

Figure 187

Plusia gamma ab. *californica* Speyer, 1875, p. 164.

Plusia ou var. *californica*: Smith, 1893, p. 252.

Autographa californica var. *russea* (Edwards), 1886, p. 70; Ottolengui, 1902, p. 65. [= var. of ou]

Plusia californica: Hampson, 1908, p. 105.

Phytometra californica: Hampson, 1913, pp. 540, 541.

Autographa californica: McDunnough, 1916, p. 400.

Male genitalia (fig. 53).—Valve tapering from the broad median section to a narrower, rounded apex; otherwise typical of the genus, refer to the description of the genus and key to species.

Female genitalia (fig. 113).—Ostium bursae typical of the genus; ductus bursae short, membranous initially, then strigate, sclerotized and bending to the left before entering the corpus bursae on the left side; corpus bursae straight, constricted around the middle, where it is strigate, produced into a thickened hump to the left, caudad, and tapering strongly to a narrow, blunt apex from which arises the ductus seminalis.

Larvae.—Integument with minute graules; ribs of mandible extend to cutting margin; head may or may not have lateral black stripe; crochets range from 18 to 20 in number; raduloid of hypopharynx with 12 ridges; otherwise typical for the genus.

Type.—[?] (*californica*). A female syntype of *russea* from Colorado in the American Museum of Natural History has been selected and labeled, and is presently designated as the lecto-

type. The second female syntype is from California.

Type locality.—[?] (*californica*). Colorado (*russea*).

Host plant.—*Ceanothus* sp., *Chenopodium album*, *Citrullus vulgaris*, *Cucumis melo*, *C. sativus*, *Cucurbita maxima*, *Dahlia variabilis*, *Daucus carota*, *Doronicum* sp., *Helianthus* sp., *Ilex opaca*, *Kalmia* sp., *Lactuca canadensis*, *Linum sulcatum*, *Malus pumila*, *Malva* sp., *M. rotundifolia*, *Medicago sativa*, *Melilotus alba*, *Mentha* sp., *M. spicata*, *Pisum sativum*, *Plantago* sp., *Rhododendron* sp., *Ribes grossularia*, *R. sativum*, *Rosa* sp., *Rubus idaeus*, *Rumex* sp., *Sambucus canadensis*, *Trifolium* sp., *Vicia sativa*, *Viguiera deltoidea*, *Zea mays*, Tietz (1972); *Allium cepa*, *Amelanchier florida*, *Amsinckia douglasiana*, *Apium graveolens*, *Atriplex* sp., *Beta vulgaris*, *Brassica oleracea* varieties; *B. rapa*, *Calendula officinalis*, *Carthamus tinctorius*, *Castilleja* sp., *Citrus sinensis*, *Erechtites arguta*, *Fragaria* sp., *Gossypium* sp., *Hordeum vulgare*, *Lactuca sativa*, *Lupinus* sp., *Lycopersicon esculentum*, *Nemophila menzeisii*, *Phaseolus* sp., *Podocarpus* sp., *Raphanus sativus*, *Rheum* sp., *Senecio cineraria*, *S. jacobaea*, *Solanum tuberosum*, *Spinacea oleracea*, *Triticum aestivum*, *Vitis* sp.

Range (map 6).—Alberta and British Columbia; Kansas, Nebraska; Western United States; Mexico.

Comments.—This species is commonly termed the "alfalfa looper." Specimens of larvae were borrowed from the laboratory culture at the University of California, Riverside.

Autographa pseudogamma (Grote)

Figure 188

Plusia pseudogamma Grote, 1875c, p. 203.

Autographa pseudogamma: Dyar, 1902, p. 81.

Phytometra pseudogamma: Hampson, 1913, pp. 539, 540.

Autographa pseudogamma: McDunnough, 1916, p. 400.

Male genitalia (fig. 57).—Typical, refer to description of genus and key to species.

Female genitalia (fig. 116).—Ostium bursae typical; ductus bursae typical with appendage near base of ostium bursae present, entrance to

corpus bursae on right side; corpus bursae elongate, somewhat pointed cephalad, and with no thickened area or protuberance cephalad of ductus bursae entrance.

Type.—British Museum (Natural History).

Type locality.—Cape Breton, Nova Scotia.

Host plant.—Unknown.

Range (map 15).—Nova Scotia to British Columbia, north to Alaska; south to Maine, Michigan, South Dakota, Montana, Wyoming, Arizona; and California.

Autographa v-alba Ottolengui

Figure 189

Autographa v-alba Ottolengui, 1902, p. 73.

Syngrapha v-alba: Hampson, 1913, pp. 429, 430.

Autographa v-alba: McDunnough, 1938, p. 113.

Male genitalia (fig. 52).—Valve slightly upturned apically, cornutus of aedeagus short; otherwise typical of genus.

Female genitalia (fig. 131).—Ostium bursae longer than wide; ductus bursae typical, and with no caudal projection, entering corpus bursae on right side; corpus bursae saclike, ovoid and broadly rounded at the apex, with a large, semilunate, thickened and pigmented protuberance on the corpus bursae just cephalad and slightly to the right of the ductus bursae entrance.

Type.—Female, American Museum of Natural History.

Type locality.—Yellowstone Park, Wyo.

Host plant.—Unknown.

Range (map 5).—Alberta and British Columbia; Northwestern United States.

Comments.—The specimens studied agreed with the type examined in the American Museum of Natural History.

Autographa pasiphaeia (Grote)

Figure 190

Plusia pasiphaeia Grote, 1873a, p. 146.

Autographa pasiphaeia: Dyar, 1902, p. 81.

Phytometra pasiphaeia: Hampson, 1913, p. 546.

Autographa pasiphaeia: McDunnough, 1916, p. 400.

Male genitalia (fig. 44).—Overall size of genitalia smaller than typical for genus, but this

may be a function of the overall smaller size of the moth; valve with straight costal border; otherwise typical of the genus, refer to generic description.

Female genitalia (fig. 123).—Ostium bursae short, about one-half as long as wide from a ventral aspect; ductus bursae typical with no caudal appendage, entering the corpus bursae on the right side well beyond apex; corpus bursae broadly rounded cephalad, tapering gently to a rounded apex; a semilunate, pigmented protuberance mesad on corpus bursae and cephalad of entrance of ductus bursae.

Type.—A male syntype of *pasiphaeia* in the American Museum of Natural History has been selected, labeled and is presently designated as the lectotype: "*Plusia pasiphaeia* Gr./No. 11301, Collection Hy. Edwards/152/California."

Host plant.—*Stachys ajugoides*, *S. rigida*.

Range (map 17).—California and Oregon.

Autographa flagellum (Walker)

Figure 191

Plusia flagellum Walker, 1857, p. 909.

Plusia monodon Grote, 1875c, pp. 202, 203.—Smith, 1893, p. 251.

Autographa flagellum: Dyar, 1902, p. 81.

Autographa insolita (Smith), 1895, p. 340, pl. 51, fig. 17.—Ottolengui, 1902, p. 67.

Phytometra flagellum: Hampson, 1913, pp. 541, 542.

Autographa flagellum: McDunnough, 1916, p. 400.

Male genitalia (fig. 47).—Valve slightly narrowed and upturned apically; basal cornutus of aedeagus may be curved or straight, but proportionate length of cornutus to length of aedeagus remains about the same (see key to species); otherwise typical of genus.

Female genitalia (fig. 119).—Ostium bursae typical; ductus bursae membranous initially, then strigate, expanding abruptly to twice its width for remainder of cephalic one-half, entering corpus bursae on the right side; protuberance on corpus bursae cephalad of ductus bursae entrance large, at its base about one-fourth length of corpus bursae.

Type.—Syntypes, British Museum (Natural History) (*flagellum*). British Museum (Natural

History) (*monodon*). Lectotype male, National Museum of Natural History (*insolita*), designated by Todd (1972).

Type locality.—St. Martins Falls, Ontario (*flagellum*). Cape Breton, Nova Scotia (*monodon*). Calgary, Alberta (*insolita*).

Host plant.—*Helianthus* sp., *Liatris* sp., Tietz (1972).

Range (map 15).—Canada; Maine and New Hampshire.

Autographa metallica (Grote)

Figure 192

Plusia metallica Grote, 1875b, p. 311.

Plusia scapularis Edwards, 1882, p. 127; *Plusia lenzii* French, 1889, p. 161—Ottolengui, 1902, p. 63.

Phytometra metallica: Hampson, 1913, p. 523.

Autographa metallica: McDunnough, 1916, p. 400.

Autographa kasloenses Strand, 1916, pp. 47–50.—Barnes and Benjamin, 1923, p. 213.

Male genitalia (fig. 51).—Valve narrowly rounded and upturned apically; refer to description of genus and key to species.

Female genitalia (fig. 134).—Ostium bursae typical, ductus bursae long, strigate, sclerotized except for initial portion, ropelike and with strigate appendage near base of ostium bursae, entrance to corpus bursae on the right side; main body of corpus bursae circular with a long narrow apex curved and appressed to side of corpus bursae; no thickened area or protuberance present on corpus bursae.

Type.—British Museum (Natural History) (*metallica*). A male syntype of *scapularis* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "*Plusia scapularis* Hy. Edw., Type/USNM Type No. 34107/Collection: Brooklyn Museum/Col. B. Neumogen/Was. T. *metallica* Grt." Female, [?] J. Behrens Collection (*lenzii*). British Museum (Natural History) (*kasloenses*).

Type locality.—California (*metallica*). Washington Territory (*scapularis*). Siskiyou, Shasta County, Calif. (*lenzii*). Kaslo, British Columbia (*kasloenses*).

Host plant.—Unknown.

Range (map 11).—Northwest United States to California; Alberta and British Columbia.

Autographa speciosa Ottolengui

Figure 193

Autographa speciosa Ottolengui, 1902, p. 73.

Syngrapha speciosa: Hampson, 1913, p. 420.

Autographa speciosa: McDunnough, 1938, p. 113.

Male genitalia (fig. 46).—Typical, refer to description of genus and key to species.

Female genitalia (fig. 132).—Description the same as for *v-alba* except the corpus bursae has no thickened area or protuberance cephalad of entrance of ductus bursae.

Type.—Female, American Museum of Natural History.

Type locality.—Livingston, Vancouver, British Columbia.

Host plant.—Unknown.

Range (map 5).—Vancouver, British Columbia.

Comments.—The specimens examined agreed with the type examined in collection of American Museum of Natural History.

Autographa labrosa (Grote)

Figure 194

Plusia labrosa Grote, 1874c, pp. 207, 208.

Autographa labrosa: Dyar, 1902, p. 81.

Phytometra labrosa: Hampson, 1913, p. 530.

Autographa labrosa: McDunnough, 1916, p. 400.

Male genitalia (fig. 50).—Typical, refer to the description of genus and key to species.

Female genitalia (fig. 121).—The description for this species is the same as for the following species, *corusca*, with the following exceptions: Corpus bursae in all specimens examined strigate on caudal one-half in *labrosa*; apex not as narrow and thickened protuberance on corpus bursae apparently more pronounced in *labrosa*.

Type.—Male, British Museum (Natural History).

Type locality.—Sausalito, Calif.

Host plant.—*Scrophularia californica*.

Range (map 2).—Central coast of California.

Autographa corusca (Strecker)

Figure 195

Plusia corusca Strecker, 1885, p. 178.

Autographa corusca: Dyar, 1902, p. 81.

Phytometra corusca: Hampson, 1913, p. 529.

Autographa corusca: McDunnough, 1916, p. 400.

Male genitalia (fig. 48).—Typical, refer to description of genus and key to species.

Female genitalia (fig. 118).—Ostium bursae infolded dorsolaterally where it is strigate and sclerotized, the lower portion of caudal end expanded ventrad; initial portion of ductus bursae membranous, then strigate and sclerotized with caudal projection directed dorsad, and tubelike ductus looping to the right before entering the corpus bursae on the right side; corpus bursae laterally compressed, broadly rounded cephalad, tapering to narrow, rounded apex from which the ductus seminalis arises; the thickened protuberance on the corpus bursae just cephalad of the entrance of the ductus bursae contains clear tubular structures internally.

Larvae.—Abdominal segment 1 with SV-2 present; mandible with ribs extending to cutting margin; raduloid of hypopharynx with 13 ridges. The above larval description is based on a single larval exuvium in the collection of the National Museum of Natural History. This was the same material used by Crumb (1956). The species will key to couplet 11 in the larval key. More characters need to be examined in order to differentiate the species.

Type.—[?] Chicago Field Museum.

Type locality.—Colorado.

Host plant.—*Alnus* sp., Crumb (1956); *Salvia leucophylla*.

Range (map 15).—Alaska to California and Colorado.

Autographa mappa (Grote and Robinson)

Figure 196

Plusia mappa Grote and Robinson, 1868, pp. 204, 205.

Autographa mappa: Dyar, 1902, p. 81.

Phytometra mappa: Hampson, 1913, p. 533.

Autographa mappa: McDunnough, 1916, p. 400.

Male genitalia (fig. 42).—Typical, refer to the description of the genus and key to species.

Female genitalia (fig. 120).—Ostium bursae slightly longer than wide, bell shaped; ductus bursae typical of the genus, but with no caudal projection, curving ventrad in the middle, then to the right, where it enters the corpus bursae on the right side; corpus bursae essentially the same shape as *bimaculata*, but with a tough, thickened area well cephalad of the entrance of the ductus bursae, strigations confined to region of ductus bursae entrance.

Larvae.—Very similar to *ampla* except crochets range from 18 to 22 in number; raduloid of hypopharynx with 19 ridges; and bases of setae on head and venter of thorax ringed with black.

Type.—Male, [?] British Museum (Natural History).

Type locality.—Canada.

Host plant.—*Urtica lyalli*, Crumb (1956); *Cas-cara* sp., Prentice (1962).

Range (map 2).—Nova Scotia to British Columbia; south to New York and west to Minnesota.

Comments.—Parental female of laboratory culture was collected at black light in Lincoln, Me.

Autographa ampla (Walker)

Figure 197

Plusia ampla Walker, 1857, p. 910.

Autographa ampla: Dyar, 1902, p. 81.

Autographa alterna (Strecker), 1885, p. 78—Otto-lengui, 1902, p. 73.

Phytometra ampla: Hampson, 1913, pp. 570, 571.

Autographa ampla: McDunnough, 1916, p. 400.

Male genitalia (fig. 55).—Typical, refer to the description of the genus and key to species.

Female genitalia (fig. 114).—Ostium bursae shaped like a teacup, smoothly sclerotized with infolds subdorsally, ductus bursae slender, sclerotized, strigate throughout except for initial, short, membranous section; a short projection to the left off ductus bursae caudad; corpus bursae large, membranous and saclike, narrowed slightly to a broadly rounded apex from

which the ductus seminalis arises; a round, thickened, pigmented protuberance is present dorsally on corpus bursae cephalad of entrance of ductus bursae, which enters on the right side.

Larvae.—Integument without conspicuous microspines; abdominal segment 1 with seta SV-2 present (characteristic of *Syngrapha* larvae); mandible with ribs 2 and 3 terminating in processes before reaching cutting margin; crochets range from 24 to 28 in number; raduloid of hypopharynx with 18 ridges; other characters the same as generic description.

Type.—Syntypes not seen by us, British Museum (Natural History) (*ampla*). Chicago Field Museum (*alterna*).

Type locality.—St. Martins Falls; Orilla [Ontario] (*ampla*). Colorado (*alterna*).

Host plant.—*Shepherdia canadensis*, McGuffin (1954); *Alnus* sp., Ross and Evans (1957); *Prunus* sp., Salix sp., Crumb (1956); *Betula pendula*, *Populus balsamifera*, *P. tremuloides*, Prentice (1962); *Alnus oregona*, *Amelanchier florida*, *Viburnum cassinoides*.

Range (map 1).—Nova Scotia to British Columbia; south to North Carolina in the East and to Arizona and California in the West.

Comments.—Parental female of laboratory culture was collected in Schoolcraft County, Mich.

Syngrapha Hübner

Generotype.—*Noctua devergens* Hübner [1818]. Designated by Grote, 1895b, p. 62.

Syngrapha Hübner, 1821, p. 250.

Autographa: Hampson (*nec* Hübner), 1913, p. 404, (*partim*).

Caloplusia: Kostrowicki, 1961, p. 381, (*partim*).

Syngrapha: Ichinose, 1962, p. 28.

Anagrapha McDunnough, 1944, p. 202, (new synonymy).

Kostrowicki (1961) uses *S. interrogationis* (L.) as the generotype of *Syngrapha*, because he considered *S. devergens* to belong to *Caloplusia* Smith based on the presence of spines on all tibiae of the latter species. He also places *S. alticola* (Walker) in *Caloplusia*. However, *S. alticola* lacks spines on all but the hind tibiae.

Due to the similarity of the genitalia and larvae, the authors contend that the above two genera are synonymous and should not be separated solely on the basis of the degree of tibial spining.

Anagrapha McDunnough is considered here to be a synonym of *Syngrapha*. The only species of *Anagrapha*, *falcifera* Kirby, has characters of the larva which closely associates it with a complex of *Syngrapha* species.

Species of this genus can be identified by the small spines on the hind tibiae between the two pairs of spurs or on all tibiae on *ignea*. Some species may have only one or two spines; the number apparently varies intraspecifically. Several species can be easily confused on general inspection, but can be differentiated on the basis of their genitalia. Few generalizations can be made regarding the genitalic characters. In the males, the clavus is reduced to a short knob with a broad base, with the exception of *ottolenguii* in which the clavus is long and filiform as in the genus *Autographa*. The tegumen, vinculum, and valves of *Syngrapha* species are comparatively shorter than those of *Autographa* species. The ampulla varies considerably in thickness, shape, and length. The juxta may be produced apically into a sharp, sclerotized spine. The vesica of the aedeagus usually has a basal or apical cornutus or both. *Syngrapha ignea* and an undescribed species have plates of several small cornuti, and a few species have no armament at all on the vesica.

The female genitalia are described under the species descriptions that follow.

The similarities of the larvae of *Syngrapha* species to the species of *Autographa* are the fusion of the pinacula of SV-1 and SV-2 on abdominal segments 2-4; no vestige of prolegs on abdominal segments 3 and 4; the presence of a raduloid in some species; and the absence of SV-2 on the meso- and metathorax in some species. The larvae of *Syngrapha* species differ by having seta SV-2 on abdominal segment 1. One group of species has seta SV-2 on the meso- and metathorax, which is considered by Crumb to be a unique situation for noctuid larvae. The raduloid is missing in several species. On those species with a raduloid, where larvae were examined, the number of ridges ranges from 10 to 12.

KEY TO THE SPECIES BASED ON MALE GENITALIA

1. Costa of valve with preapical spine 2
Costa without preapical spine 4
2. Ampulla long, thin, and straight, extending beyond costal margin; one cornutus about two-thirds as long as aedeagus (fig. 58) *epigaea*
Ampulla broadly triangular; cornutus not as above 3
3. Valve abruptly narrowed to a blunt point from preapical spine to apex (fig. 62a); aedeagus with a patch of several small cornuti (fig. 62b) (*unnamed species*)
Apex of valve broadly rounded beyond preapical spine (fig. 66a); aedeagus with one large apical cornutus (fig. 66b) *octoscripta*
4. Costa produced apically into sharp spine (fig. 72a) 5
Costa without apical spine; apex merely sharply angled or rounded 8
5. Aedeagus with a small basal and a curved median cornutus (fig. 69b) *viridisigma*
Aedeagus with only one cornutus 6
6. Aedeagus with basal cornutus; ampulla with knobbed apex directed ventrad (fig. 87) *falcifera*
Aedeagus with apical cornutus (fig. 60b); ampulla extending dorsad at least to costal margin (fig. 60a) 7
7. Cornutus more than one-third as long as aedeagus (fig. 72b) *selecta*
Cornutus smaller, about one-fifth as long as aedeagus (fig. 60b) *altera*
8. Aedeagus with cornuti 9
Aedeagus without cornuti 26
9. Aedeagus with basal and apical cornuti 10
Aedeagus with only one cornutus 16
10. Many small cornuti projecting from basal and apical sclerites (fig. 63b) *ignea*
Aedeagus with only two cornuti 11
11. Basal cornutus large (fig. 73b) 12
Basal cornutus minute (fig. 65b) 15
12. Ampulla short (fig. 73a) *sackeni*
Ampulla elongate (fig. 70a) 13
13. Ampulla long and outcurved and on right valve more strongly outcurved, subparallel with costal margin; ampulla on left valve more erect (fig. 70a) *orophila*
Ampulla not outcurved and approximately symmetrical 14
14. Ampulla tapering gradually to a point; apex of juxta produced to a strong, sharp point (fig. 76) *angulidens*
Ampulla with a broad base, narrowed abruptly to a point at terminal one-third; apex of juxta only slightly pointed (fig. 61a) *celsa*
15. Juxta with a spine (fig. 18) *microgamma*
Juxta without a spine (fig. 65a) *montana*
16. Aedeagus with basal cornutus (fig. 68b) *ottolenguii*
Aedeagus with apical cornutus 17
17. Cornutus strongly curved and with broad base (fig. 78b) 18

- Cornutus either uncurved or short and stubby (rose-thorn) (fig. 79b) 21
18. Ampulla with minute apical spine (fig. 77a) or represented by a broad ridge (fig. 71a) 19
Ampulla extending almost to costal margin (fig. 64a) *abstrusa*
19. Ampulla merely a broad ridge truncate apically (fig. 71a) *cryptica*
Ampulla short and tuberclelike pointed apically 20
20. Base of sacculus greatly produced mesad and bluntly triangular (fig. 78a) *alias*
Base of sacculus not produced mesad to form a blunt triangle (fig. 77a) *rectangula*
21. Cornutus short and stubby (rose-thorn) (fig. 79b) 22
Cornutus long and straight 23
22. Base of costa with a sharp spine (fig. 79a) *interrogationis*
Base of costa without spine (fig. 80a) ... *u-aureum*
23. Ampulla terminated by a bifid spine (fig. 74a) *surena*
Ampulla not terminated by a bifid spine 24
24. Ampulla with a truncate apex and small terminal spine *borea*
Ampulla tapering to a sharp point 25
25. Valve subtruncate at apex (fig. 83a) *diasema*
Valve tapering apically to bluntly rounded point (fig. 81a) *lula*
26. Juxta with strong apical spine; ampulla with broad spine base and terminating in a sharp spine (fig. 75a) *alticola*
Juxta with a strong apical point but not a distinct sclerotized apical spine; ampulla tapering to a point but without distinct terminal spine (fig. 67a) *parilis*

(*S. snowi* not seen. *S. borea* was not seen but was placed in the above key based on genitalic descriptions provided by McDunnough (1944).)

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

1. Entrance of ductus bursae on right side of corpus bursae 2
Entrance of ductus bursae on left side of corpus bursae 10
2. Apex of corpus bursae heavily sclerotized or strigate or darkened 3
Apex of corpus bursae not as described above .. 6
3. Base of ostium bursae with lateral appendage on right side 4
No appendage on ostium bursae 5
4. Projection off cephalic end of ostium bursae directed caudad (fig. 124) *celsa*
Projection off cephalic end of ostium bursae directed laterad (fig. 126) *angulidens*
5. Ventral surface of apex pigmented (fig. 19) . *ignea*
Pigmentation of apex confined to area around base of ductus seminalis (fig. 129) *montana*

6. Base of ostium bursae with short lateral process (fig. 133) 7
Base of ostium bursae without process 9
 7. Projection off ostium bursae almost or entirely membranous (fig. 133) *rectangula*
Projection off ostium bursae sclerotized 8
 8. Width of ductus bursae at entrance to corpus bursae greater than one-half of length of ductus bursae (fig. 147) *cryptica*
Width of ductus bursae at entrance to corpus bursae one-half or less but greater than one-fifth of length of ductus bursae (fig. 130) *alias*
Width of ductus bursae at entrance to corpus bursae about one-fifth of length of ductus bursae (fig. 145) *abstrusa*
 9. Ostium with lateral pouchlike structures (fig. 128) *alticola*
Ostium with laterocaudal extension of a long, heavily sclerotized ostium bursae; juncture of ductus bursae with ostium bursae a swollen, darkened structure, the ductus bursae and ostium bursae forming a right angle (fig. 127) *surena*
 10. Apex of corpus bursae heavily sclerotized, strigate, or darkened (fig. 135) 11
Apex of corpus bursae membranous or merely granulose (fig. 152) 17
 11. Apex of corpus bursae strigate or with deep lateral fold 12
Apex of corpus bursae not strigate or infolded . 13
 12. Apex of corpus bursae darkened and deeply infolded on right side (fig. 137) *epigaea*
Apex of corpus bursae not as above; ductus seminalis arises from cephalic end of apical region (fig. 135) *falcifera*
 13. Ductus bursae entirely membranous; apex of corpus bursae shagreened and dark, curving to left dorsad of ductus bursae (fig. 143) . *viridisigma*
Ductus mostly or entirely sclerotized and strigate; apex of corpus bursae may be darkened but not curving to left dorsad of ductus bursae 14
 14. Ductus bursae with a membranous swelling on right side (fig. 139) 15
Ductus bursae without a membranous swelling on right side 16
 15. Apex of corpus bursae with brown, sclerotized plate extending down right side of ductus bursae (fig. 139) *orophila*
Apex of corpus bursae heavily shagreened and dark (fig. 138) *microgamma*
 16. Ductus bursae about as wide as base of ostium bursae with membranous bulge on left side near ostium bursae (fig. 136) *sackeni*
Ductus bursae about twice as wide as base of ostium bursae, without membranous bulge, and curves to the left (fig. 140) *snowi*
 17. Ostium bursae, wide and long, extending cephalad beyond apex of corpus bursae 18
Ostium bursae shorter, not extending as far as apex of corpus bursae 23
 18. Caudal extension of ventral plate of ostium bursae produced beyond ostium to a length greater than its own width in ventral aspect 19
Caudal extension of ventral plate of ostium bursae only slightly produced beyond ostium to a length less than its own width in ventral aspect .. 21
 19. Cephalad extension of ostium bursae beyond origin of ductus bursae projected on right side, one-half as wide as ostium bursae (fig. 141) . *octoscripta*
Cephalad extension of ostium bursae beyond origin of ductus bursae not confined to right side and larger than in fig. 141 20
 20. Cephalad extension of ostium bursae mostly membranous (fig. 142) *selecta*
Cephalad extension of ostium bursae mostly sclerotized (fig. 144) *altera*
 21. Apex of bursae a well-defined region since it is constricted at its origin from the corpus bursae proper (fig. 146) *ottolenguii*
Apex of corpus bursae not distinctly separated by constriction from corpus bursae proper 22
 22. Corpus bursae sharply curved forming an acute angle (fig. 148) *u-aureum*
Corpus bursae if curved then angle obtuse (fig. 150) *interrogationis*
 23. Ductus bursae enters corpus bursae ventrad toward left (fig. 152) *parilis*
Ductus bursae enters corpus bursae laterad ... 24
 24. Base of ostium bursae produced to right as a short membranous sac 25
No membranous sac on right side at base of ostium bursae. *diasema*
 25. Ostium bursae produced caudad as two sublateral, winglike extensions *borea*
Ostium bursae not produced caudad as winglike extensions (fig. 153) *lula*
- (*Syngrapha borea* and *diasema* are placed in this key on the basis of genitalic descriptions provided by McDunnough, 1944.)
- Syngrapha ottolenguii* (Dyar), new combination
- Figure 198
- Autographa arctica* Ottolengui, 1902, p. 66. [preoccupied]
- Autographa ottolengui* Dyar, 1903, p. 200. [new name pro *arctica*]
- Autographa vaccinii* (Edwards), 1886, p. 170.—McDunnough, 1921, p. 85.
- Male genitalia (fig. 68).**—Male genitalia of the same general form as species of *Autographa*: Valve broad toward apex; ampulla long and slender, extending beyond costal margin; clavus long, filiform; vinculum longer than in *Syngrapha*, tapered to a pointed apex, with relatively long, ventral projections near apex; aedeagus with strong, basal cornutus.
- Female genitalia (fig. 146).**—Ostium bursae wide, heavily sclerotized, long, extending ce-

phalad well beyond apex of corpus bursae, and the venter extending caudad beyond ostium; ductus bursae membranous, about as long as greatest width of ostium bursae, entering corpus bursae on right side near the middle; corpus bursae in area around ductus bursae entrance strigate, somewhat sclerotized; main portion of corpus bursae membranous, no longer than ostium bursae, with apex a distinct membranous sac; ductus seminalis arises from apex of corpus bursae.

Type.—National Museum of Natural History.

Type locality.—Alter Islands, Alaska.

Host plant.—Unknown.

Range (map 11).—Alaska and Yukon Territory.

Comments.—This species has spines on the hind tibiae, which is typical of species of *Syngrapha*, and the female genitalia are also like *Syngrapha* and not *Autographa*. Larval specimens are needed for further clarification.

Syngrapha altera (Ottolengui)

Figure 199

Autographa altera Ottolengui, 1902, p. 69.

Syngrapha altera: Hampson, 1913, p. 429.

Autographa altera: Barnes and McDunnough, 1917, p. 83.

Syngrapha variana (Ottolengui), 1902, p. 70—McDunnough, 1944, p. 197.

Male genitalia (fig. 60).—Valve somewhat narrowed in caudal third, produced costoapically into a short spine; ampulla arises from a broad base and extends just beyond costal margin, slightly curved; clavus sharply bent, apex projecting toward apex of valve; aedeagus with apical cornutus, about one-fifth as long as aedeagus.

Female genitalia (fig. 144).—Ostium bursae very wide, extending cephalad beyond the apex of corpus bursae to a blunt point beyond origin of ductus bursae, and extending caudad well beyond ostium as a heavily sclerotized, strigate ventral plate longer than wide caudad of ostium; ductus bursae short, strigate, originating from left side of ostium bursae, projected ventrad and bending cephalad to enter corpus bursae on the left side; corpus bursae small,

subequal in length to ostium bursae and shagreened on apex.

Type.—Female, American Museum of Natural History.

Type locality.—Lake Nipigon, Ontario.

Host plant.—Unknown.

Range (map 18).—Nova Scotia to Ontario; south to New York and Michigan.

Comments.—Adult specimens studied here agree with the type examined in the American Museum of Natural History.

Syngrapha octoscripta (Grote)

Figure 200

Plusia octoscripta Grote, 1874a, p. 72.

Autographa octoscripta: Dyar, 1902, p. 81.

Syngrapha octoscripta: Hampson, 1913, pp. 425, 426.

Autographa pallida Ottolengui, 1902, p. 71; *variana* Ottolengui, 1902, pp. 70, 71; *zeta* Ottolengui, 1902, p. 70; *epsilon* Ottolengui, in Dyar, 1900, p. 495—Barnes and McDunnough, 1917, p. 83.

Autographa magnifica Ottolengui, 1919, p. 124—McDunnough, 1938, p. 113.

Syngrapha octoscripta: McDunnough, 1944, p. 198.

Male genitalia (fig. 66).—Valve with preapical spine projecting from costal margin; apex of valve round; ampulla triangular with a broad base; aedeagus with apical cornutus; apex of aedeagus externally shagreened.

Female genitalia (fig. 141).—Ostium bursae long, flat, heavily sclerotized, extending cephalad beyond origin of the ductus bursae on the right side and about half the width of the ductus bursae, and extending caudad as a ventral plate well beyond the ostium about twice as far as its own width from a ventral aspect; ductus bursae about as wide as ostium bursae, short, S-shaped from left lateral aspect, sclerotized, and heavily strigate, entering corpus bursae on the left side; corpus bursae membranous and shagreened throughout.

Type.—[?] Syntype, British Museum (Natural History) (*octoscripta*). Female, American Museum of Natural History (*pallida*). Female, American Museum of Natural History (*var-*

iana). Female, American Museum of Natural History (*zeta*). Male, National Museum of Natural History (*epsilon*). Female, Canadian National Collection, Ottawa, Ontario (*magnifica*).

Type locality.—[?] (*octoscripta*). Salmonier, Newfoundland (*pallida*). St. John, New Brunswick (*variana*). Calgary, Alberta (*zeta*). Kodiak, Alaska (*epsilon*). Ucluelet, Vancouver [British Columbia] (*magnifica*).

Host plant.—*Vaccinium* sp.

Range (map 12).—Newfoundland to Northwest territory, Alaska south to New York, Michigan, Wisconsin, Idaho, British Columbia.

Comments.—McDunnough (1944) spoke of the form *magnifica*, a female type and a male specimen from Ucluelet, British Columbia. Though lighter in color, these two specimens proved to be conspecific with *octoscripta*, based on comparisons of the genitalia of each sex of both forms. A male, labeled as *magnifica* in the American Museum of Natural History, from the type locality of *magnifica* and superficially resembling it, is quite unique and not a subspecies of *octoscripta*. Refer to the illustration of the genitalia (fig. 64, 65). We have deferred naming this species until additional specimens can be examined.

Syngrapha epigaea (Grote)

Figure 201

Plusia epigaea Grote, 1874c, p. 208.

Autographa epigaea: Dyar, 1902, p. 81.

Syngrapha epigaea: Hampson, 1913, p. 421.

Autographa epigaea: Barnes and McDunnough, 1917, p. 83.

Syngrapha epigaea; McDunnough, 1944, p. 200.

Male genitalia (fig. 58).—Valve wide; ampulla thin, straight, extending just beyond costal margin; costa produced as a spine before apex; cornutus large, thick, one-half as long as aedeagus.

Female genitalia (fig. 137).—Ostium bursae long, about two-thirds length of corpus bursae, extending well past the apex of the corpus bursae, heavily sclerotized, expanded caudally and produced into two lateral extensions that taper to a point directed dorsad, extending well beyond ostium; the initial portion of the ductus bursae is membranous and narrower than the

ostium bursae, directed ventrad from the ostium bursae, becoming strigate and sclerotized after it becomes directed to the right, expanding to a width of at least one-third the length of the corpus bursae, which it enters on the left side well cephalad of the apex; the midsection of the corpus bursae is constricted with the fundus membranous and minutely granulose; the corpus bursae is strigate on the left side from the fundus to the apex of the corpus bursae; the right side of the apex is heavily shagreened imparting a brownish color to it and deeply infolded with the ductus seminalis arising within the fold at the caudal end.

Larvae.—Integument with microspines like minute setae; crochets range from 23 to 30 in number; seta SV-2 absent on meso- and meta-thorax; interval between the pinacula of setae V-1 on abdominal segment 4 more than one-half the interval between V-1 and SV-2; raduloid on hypopharynx with 12 ridges; otherwise same as generic description.

Type.—British Museum (Natural History).

Type locality.—New York.

Host plant.—*Amelanchier alnifolia*, *Larix* sp., *Spiraea* sp., McGuffin (1954); *Pinus contorta*, *Populus tremuloides*, *Vaccinium* sp., Ross and Evans (1957); *Alnus* sp., *Betula pendula*, *Juniperus* sp., *Pinus banksiana*, *Salix* sp., Prentice (1962); *Vaccinium angustifolium*, Wood (1951); *Gale palustris*, *Kalmia angustifolia*.

Range (map 19).—Newfoundland to British Columbia; south to New York, Wyoming, and Colorado.

Comments.—Larvae of this species were collected in commercial blueberry fields by workers in the Canada Department of Agriculture, New Brunswick. Larvae were reared to adults for identification and association with larval specimens. The specimens were obtained from G. W. Wood.

Syngrapha selecta (Walker)

Figure 202

Plusia selecta Walker, 1875, p. 912.

Plusia viridisigma: Smith (*nec* Grote), 1893, p. 255.

Autographa selecta: Dyar, 1902, p. 81.

Syngrapha selecta: Hampson, 1913, pp. 421, 422.

Autographa selecta: Dod, 1915, p. 130.

Syngrapha selecta: McDunnough, 1944, p. 201.

Male genitalia (fig. 72).—Valve slender, somewhat tapered to apex from which arises a relatively long spine, compared to the apical spine of *viridisigma*; ampulla arises from a wide base, curves basad and extends just beyond costal margin; clavus sharply bent with apex directed toward valve apex; aedeagus with a large, thick apical cornutus, about one-third as long as aedeagus.

Female genitalia (fig. 142).—Ostium bursae heavily sclerotized, sides infolded dorsad, extending cephalad far beyond apex of corpus bursae, the cephalic extension twice as wide beyond origin of ductus bursae and a large, thick, mostly membranous sac dorsad of corpus bursae; ostium protected ventrally by a heavily sclerotized, scooplike plate which arises from ostium bursae near origin of ductus bursae; ductus bursae very short, about as wide as long, mostly sclerotized and strigate, arising from membranous sac of ostium bursae, entering corpus bursae on the left side; corpus bursae and membranous sac, somewhat narrowed at apex, which is lightly shagreened.

Larvae.—Similar to *viridisigma* with the following exceptions: Crochets range from 21 to 24 in number; interval between pinacula of setae V-1 on abdominal segment 4 one-half the interval between setae V-1 and SV-2; mesothorax with pinaculum of D-2 equidistant from D-1 and SD-2; and raduloid on hypopharynx has 11 ridges.

Type.—Female, British Museum (Natural History).

Type locality.—St. Martins Fall, Albany River, Hudson Bay District, Ontario.

Host plant.—Unknown; some host records for *viridisigma* recorded in literature erroneously for *selecta* probably apply to *selecta* as here corrected.

Range (map 16).—Newfoundland, Ontario, and Alberta; Massachusetts, Michigan, and Wisconsin.

Comments.—This species is superficially like *viridisigma*. The color pattern of the wings may serve to select possible suspects from a mixed series of both species. In *viridisigma*, the more common species of the two, the hind wings are

dull luteous, with the outer one-third fuscous. In *selecta*, the hind wings tend toward being ochreous, contrasting more with the fuscous border. Females of *selecta* can be identified by examining the tip of the abdomen. By brushing a few scales off, the ventral plate of the ostium bursae shows as a dark, sclerotized plate from under the ovipositor. There is no ventral plate on *viridisigma* females. The males of *selecta* are also recognizable without removing the genitalia. The costoapical spines of the valves are long and curved, frequently crossing each other, as seen from the caudal aspect. Parental female of the laboratory culture was collected in Schoolcraft County, Manistique, Mich., at black light.

Refer to comments given for *viridisigma*.

Syngrapha viridisigma (Grote), new combination

Figure 203

Plusia viridisigma Grote, 1874a, p. 73.

Plusia viridisignata Grote, 1875c, p. 205.

Male genitalia (fig. 69).—Valve produced at apex into a distinct spine on costal margin; ampulla short, curved slightly caudad, with rounded apex; aedeagus with a large basal cornutus and a slightly smaller median cornutus.

Female genitalia (fig. 143).—Ostium bursae large, about as long as wide, sclerotized and creased ventrad, rounded to base; ostium oval, unprotected; ductus bursae entirely membranous except perhaps near base of ostium bursae, narrow caudad but widening to about three times this width as it enters corpus bursae on the left side; apex of corpus bursae shagreened and darkly pigmented throughout, curving to the left dorsad of ductus bursae; ductus seminalis arises from apex far to the left near entrance of ductus bursae.

Larvae.—Integument with middorsal, longitudinal band formed of dark microspines; crochets range from 25 to 28 in number; seta SV-2 absent on meso- and metathorax; interval between the pinacula of setae V-1 on abdominal segment 4 more than one-half the interval between V-1 and SV-2; mesothorax with pinacu-

lum of seta D-2 closer to D-1 than to SD-2; raduloid of hypopharynx absent.

Type.—A female syntype of *viridisigma* in the British Museum (Natural History) has been selected and labeled and is presently designated as the lecto-type: "Type, *Plusia viridisigma* Grote/Grote coll. 82-54/Type (a white disc with a red border)/*Viridisignata* Grote 1875 is unnecessary replacement name for *viridisigma* Grote, 1874, det. I. W. B. Nye, 1970."

Type locality.—Quebec.

Host plant.—*Abies lasiocarpa*, *Picea glauca*, *P. engelmannii*, *P. sitchensis*, *Pinus contorta*, *Pseudotsuga menziesii*, *Tsuga heterophylla*, Ross and Evans (1857); *Larix laricina*, *Thuja plicata*, *Tsuga mertensiana*, Prentice (1962); *Picea mariana*, Tietz (1972).

Range (map 11).—Canada and Alaska; south to New York and Wisconsin; Washington† southeast to New Mexico.

Comments.—McDunnough (1944) described this species but erroneously called it *selecta*. *Syngrapha viridisigma* is by far the more common of the two species, yet all specimens seen were labeled *selecta*. A female specimen was sent to I. W. B. Nye at the British Museum (Natural History) to compare with the types of *selecta* and its junior synonym *viridisigma*. A subsequent communication confirmed that Grote's female syntype of *viridisigma* agreed with the descriptions and illustrations presented for *selecta* by McDunnough, and the female syntype should be designated as lecto-type. A specimen of the less common species sent for comparison with the type, agreed with Walker's holotype of *selecta*, a female.

Parental females of the laboratory cultures were collected at black lights in Mare du Sault Camp, Laurentides Park, route 54, Quebec. Refer to comments given for *selecta*.

Syngrapha orophila (Hampson)

Figure 204

Plusia orophila Hampson, 1908, p. 105.

Autographa orophila: Dod, 1913, pp. 236-238.

Syngrapha orophila: Hampson, 1913, p. 416.

Autographa orophila: Barnes and McDunnough, 1917, p. 83.

Syngrapha orophila: McDunnough, 1944, p. 184.

Male genitalia (fig. 70).—Valves with ampullae asymmetrical; left valve with ampulla only slightly curved caudad, pointed apex extending beyond costal margin; right valve with ampulla strongly curved, pointed apex directed almost ventrocaudad; aedeagus with both basal and apical cornuti.

Female genitalia (fig. 139).—Ostium bursae heavily strigate, extended caudolaterally as two winglike processes somewhat protecting the ostium; ductus bursae mostly sclerotized and strigate except for a large membranous swelling on the right side; ductus bursae wide as it enters corpus bursae on left side; apex of corpus bursae with a brown pigmented, sclerotized plate extending cephalad along right side of corpus bursae.

Larvae.—Larval exuviae were examined and based on discernible characters, this species is similar to *viridisigma*. Refer to description of the latter species.

Type.—Syntypes not seen by us, British Museum (Natural History).

Type locality.—Brobokton Creek, Alberta.

Host plant.—*Vaccinium* sp., Crumb (1956).

Range (map 12).—Alberta to Alaska; south to Oregon and Wyoming.

Syngrapha snowi (Edwards)

Figure 205

Plusia snowi Edwards, 1884, pp. 44, 45.

Autographa snowi: Dyar, 1902, p. 81.

Syngrapha snowi: Hampson, 1913, pp. 418, 419.

Autographa snowi: Ottolengui, 1919, p. 27.

Syngrapha snowi: McDunnough, 1944, p. 188.

Male genitalia.—Not examined.

Female genitalia (fig. 140).—Ostium bursae bell shaped, short and broad, expanded caudad; ductus bursae bends to the left, wide, lightly sclerotized, and strigate mostly on the right side; the broadly rounded apex of corpus bursae lightly pigmented.

Type.—Male, American Museum of Natural History.

Type locality.—Hot Springs, Las Vegas, N. Mex.

Host plant.—Unknown.

Range (map 16).—New Mexico.

Syngrapha sackeni (Grote)

Figure 206

Plusia sackeni Grote, 1877, pp. 135, 136.*Autographa sackeni*: Dyar, 1902, p. 81.*Syngrapha sackeni*: Hampson, 1913, pp. 417, 418.*Autographa sackeni*: Barnes and McDunnough, 1917, p. 83.*Syngrapha sackeni*: McDunnough, 1944, p. 187.

Male genitalia (fig. 73).—Valve wide, apex broadly rounded; clavus short and broad; ampulla reduced, short, broad at apex, aedeagus with basal and apical cornuti, approximately equal in length; juxta produced to a sharp point, but not a distinct, sclerotized apical spine.

Female genitalia (fig. 136).—Ostium bursae short with no appendages or extensions protecting ostium; ductus bursae bends to the left, its initial one-third membranous and continued on left side, remainder of ductus bursae strigate and sclerotized, where it enters corpus bursae on left side, becoming about as wide as widest part of ostium bursae; corpus bursae uniformly shagreened except at apex, which is partially sclerotized and darkened.

Type.—British Museum (Natural History)**Type locality**.—Idaho Springs, Colo.**Host plant**.—Unknown.**Range** (map 19).—Alberta south to Colorado.*Syngrapha lula* Strand

Figure 207

Syngrapha snowi form *lula* Strand, 1916, p. 47*Autographa lula*: Barnes and Benjamin, 1923, p. 212.*Autographa diversigna* Barnes and Benjamin, 1923, p. 212.*Syngrapha lula*: McDunnough, 1944, p. 186.

Male genitalia (fig. 81).—Valve tapers somewhat to a narrowly rounded apex; ampulla as in *diasema*; aedeagus spiculate apically, with apical cornutus perhaps not as thick as in *diasema* but with a broad base.

Female genitalia (fig. 153).—Ostium bursae,

ductus bursae, and corpus bursae similar to *sackeni*, with the following exceptions: A thickened membranous pouch is on right side of ostium bursae, and the apex of the corpus bursae is not darkened.

Type.—British Museum (Natural History) (*lula*). American Museum of Natural History (*diversigna*).

Type locality.—Canada (*lula*). Nordegg and Laggan, Alberta, (*diversigna*)

Host plant.—Unknown.**Range** (map 12).—Alberta, British Columbia, Alaska.*Syngrapha borea* (Aurivillius)*Plusia diasema* var. *borea* Aurivillius, 1890, p. 4.*Syngrapha borea*: McDunnough, 1944, p. 187.

This species was not examined, so the following male and female genitalic descriptions are reproduced from McDunnough (1944):

“**MALE GENITALIA**. Juxta and aedeagus much as in *lula*. The harpe (= ampulla) is of moderate width throughout with *truncate apex* from the underside of which a minute spine projects; this truncate apex at once distinguishes *borea* from *diasema* and *lula* in which the harpes taper to sharp points.

FEMALE GENITALIA. Very similar to those of *lula* but with definite suggestions of weakly chitinized wings extending caudad from ostium margin. Ductus funnel (= ostium bursae) weakly chitinous and strigate, except for a strip on left side which shows stronger chitination; the base of the funnel is membranous and projects as a short sac below and to the right of the continuation of the ductus; this continuation as well as the bursa are much as in *lula*.”

Type.—[?]**Type locality**.—Greenland.**Host plant**.—Unknown.**Range** (map 14).—Greenland, Yukon, and Northwest Territory.*Syngrapha diasema* (Boisduval)

Figure 208

Plusia diasema Boisduval, 1829, p. 160.*Autographa diasema*: Dyar, 1902, p. 81.*Syngrapha diasema*: Hampson, 1913, pp. 416, 417.

Autographa diasema: Barnes and McDunnough, 1917, p. 83.

Autographa diversigna Ottolengui, 1919, p. 121.—McDunnough, 1921, p. 85.

Syngrapha diasema: McDunnough, 1944, pp. 185–186.

Male genitalia (fig. 83).—Valve broad at apex and slightly rounded; ampulla extending to costal margin, rather abruptly narrowed in distal one-fourth to a sharp pointed apex; aedeagus with a thick apical cornutus.

The female of this species was not examined, so the following female genitalic description was reproduced from McDunnough (1944):

“FEMALE GENITALIA. Ostium considerably broader than in *orophila*; the two sublateral wings project caudad but their apices are broadly rounded and not pointed. The ductus-funnel (= ostium bursae) is strongly chitinized and strigate, gradually tapering, and noticeably longer than in *orophila*. The continuation of the ductus bends to the left and is short and broad, less heavily strigate and chitinized than in *orophila*, the strigae continued for only a very short distance along the left side of the bursa, below the entrance. The bursa consists of the usual large, membranous sac; the rounded apex projects caudad along the right side of the ductus for a greater distance than in *orophila* and shows none of the chitinization found in this species, being merely finely granulate; the membrane of the remainder of the bursa is smooth.”

Type.—A male syntype of *diasema* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: “Ex Musaeo, Dris Boisduval/*Diasema*/Type, *Plusia diasema* Bdv., a/c Hofer/fig. par J. Culot, Noct. et Geom. d' Europe, Pl. 72 Fig. 6/Oberthur Collection/♂ genitalia on slide, Aug. 21, 1936, J.F.G.C. -558.”

Type locality.—Saponie, Lapland.

Host plant.—Unknown in North America; in Europe feeds on *Betula* spp. and *Populus* spp., Kostrowicki (1961).

Range (map 13).—Labrador to Alberta, and north to Alaska; Scandinavia.

Syngrapha falcifera (Kirby)

Plusia rectangulara: Walker (nec Kirby), 1857, p. 908.

Autographa falcifera: Dyar, 1902, p. 81

Autographa simplex (Guenee), 1852, p. 47.—Ottolengui, 1902, p. 74.

Syngrapha falcifera: Hampson, 1913, pp. 419, 420.

Autographa simplicima Ottolengui, 1902, pp. 74–75.—Dod, 1913, p. 239.

Anagrapha falcifera: McDunnough, 1944, p. 202.

Male genitalia (fig. 87).—Valve broad, widest at truncate apex; ampulla downcurved, with knobbed apex directed ventrad; aedeagus with a sharply pointed basal cornutus.

Female genitalia (fig. 135).—Ostium bursae narrow and short, ostium unprotected; ductus bursae relatively thick, sclerotized and strigate throughout, entering corpus bursae on the left; main body of corpus bursae membranous and saclike, but the apical region sclerotized, darkly pigmented, and spiculate, with the ductus seminalis arising from the cephalic end of the apical section.

Larvae.—Very similar to *viridisigma* with the following exceptions: Integument with microspines present but inconspicuous; head without spots; crochets range from 21 to 24 in number; interval between pinacula of setae V-1 on abdominal segment 4 one-half the interval between V-1 and SV-2.

Type.—[?] British Museum (Natural History) (*falcifera*). Syntypes, Barnes Collection, National Museum of Natural History, and British Museum (Natural History) (*simplex*). Female, American Museum of Natural History (*simplicima*).

Type locality.—Nova Scotia (*falcifera*). New York, Canada (*simplex*). Oregon (not Washington) (*simplicima*).

Host plant.—*Apium graveolens*, *Beta vulgaris*, *Brassica oleracea*, *Lactuca sativa*, *Zea mays*, Crumb (1956); *Althaea rosea*, *Arctium lappa*, *Cirsium* sp., *Daucus carota*, *Plantago* sp., *Taraxacum officinale*, *Vaccinium macrocarpan*, Tietz (1972); *Viburnum* sp.

Range (map 3).—Nova Scotia to British Columbia; United States.

Comments.—This species is generally called the celery looper. Parental females of labora-

Figure 209

Plusia falcifera Kirby, 1837, p. 308.

tory cultures were collected in a light trap at Auburn, Ala., and others were collected at light in Pittsburgh, Pa.

Syngrapha u-aureum (Guenee)

Figure 210

Plusia u-aureum Guenee, 1852, p. 354.

Autographa u-aureum: Dyar, 1902, p. 81.

Syngrapha u-aureum: Hampson, 1913, pp. 424, 425.

Autographa vaccinii (Edwards), 1886, p. 170.—Barnes and McDunnough, 1917, p. 83.

Autographa u-aureum: McDunnough, 1938, p. 113. [= *interrogationis*]

Syngrapha u-aureum: McDunnough, 1944, p. 193.

Male genitalia (fig. 80).—Similar to *interrogationis*, but on all specimens examined, with no sharp projection basad on costal margin; without projection on basal third of ampulla; costoapical edge of valve not as sharply angled as in *interrogationis*; and aedeagus much less spiculate apically.

Female genitalia (fig. 148).—Structures the same as in *interrogationis* except for the following: The elongate apical region of the corpus bursae is recurved to the left forming an angle of 90° or an acute angle with the corpus bursae, and in some specimens directed somewhat cephalad.

Larvae.—Crochets range from 27 to 30 in number; raduloid on hypopharynx with 10 ridges; otherwise similar to *viridisigma*.

Type.—A female syntype of *u-aureum* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "Ex Musaeo. Dris Boissduval/Delecarlie/*u. aureum*/Type, *Plusia u-aureum*' Bdv.', a/c Hofer/Oberthur Collection/♀ genitalia on slide, 3 Nov. 1942, C.H. #3." Syntypes, American Museum of Natural History (*vaccinii*).

Type locality.—Dele carlie, Laponie (= Lapland) (*u-aureum*). Mt. Washington, N. H. (*vaccinii*).

Host plant.—*Vaccinium* sp., Forbes (1954).

Range (map 11).—Newfoundland, Manitoba to Alaska; south to New York and Colorado.

Comments.—Parental females for laboratory cultures were collected during daylight hours while they were feeding on flowers of a small species of *Solidago* at 4,000 feet elevation on Mt. Washington, N. H.

Syngrapha interrogationis (Linnaeus)

Figure 211

Noctua interrogationis Linnaeus, 1758, p. 513.

Noctua interrogationis: Fabricius, 1781, p. 228.

Autographa interrogationis: Hübner, 1816, p. 251.

Plusia interrogationis: Treitschke, 1823, p. 190.

Syngrapha interrogationis: Hampson, 1913, p. 430, 431.

Autographa interrogationis var. *herschelensis* Benjamin, 1933, pp. 61, 62.

Autographa u-aureum (Guenee), 1852, p. 354; *vaccinii* (Edwards), 1886, p. 170.—McDunnough, 1938, p. 113.

Syngrapha interrogationis: McDunnough, 1944, p. 195.

Male genitalia (fig. 79).—Valve with costal margin basad produced as a small, sharp spine; ampulla broad from base, tapering to a pointed apex and curved toward base, with a small point on edge of basal one-third of ampulla on the European specimens examined; costoapical edge of valve sharply angled, and may even be slightly produced as a spine in some specimens; aedeagus heavily spiculate apically, with a small, stubby apical cornutus on an irregularly shaped base.

Female genitalia (fig. 150).—Ostium bursae long and wide, heavily sclerotized, extending cephalad beyond the origin of the ductus bursae as a membranous projection, and extending caudad beyond ostium ventrally as a plate often bilobed, the length of the extension beyond ostium less than its own width; ductus bursae strigate and short, about one-third the length of the ostium bursae, entering the corpus bursae on the left; corpus bursae may be bent to the right apically, but always at an obtuse angle; apex minutely granulose.

Type.—British Museum (Natural History) (*interrogationis*). Male, National Museum of Natural History (*herschelensis*).

Type locality.—[?] (*interrogationis*). Herschel Island, Yukon Territory (*herschelensis*).

Host plant.—Unknown.

Range (map 13).—Labrador to Alberta and Alaska.

Syngrapha surena (Grote)

Figure 212

Plusia surena Grote, 1882, p. 585.

Autographa surena: Dyar, 1902, p. 81.

Syngrapha surena: Hampson, 1913, p. 430.

Autographa surena: Barnes and McDunnough, 1917, p. 83.

Syngrapha surena: McDunnough, 1944, p. 200.

Male genitalia (fig. 74).—Valve broadly truncate at apex, sharply angled on costoapical edge; ampulla with broad base, tapering somewhat to apex, which is a bifid spine; aedeagus with a large, thick apical cornutus; vesica when everted forming a complete loop near the middle.

Female genitalia (fig. 127).—Ostium bursae wide, as long as ductus bursae, scooplike, extended caudad just beyond ostium, bilobed on the end; ductus bursae arises from base of ostium bursae as a thick heavily pigmented, swollen area becoming strigate and sclerotized to entrance into corpus bursae on the right side; corpus bursae membranous with apex curved to left.

Type.—Not known to us.

Type locality.—Orono, Me.

Host plant.—Unknown.

Range (map 16).—Newfoundland to Ontario; Maine.

Comments.—This species is rare in collections. No more than a dozen specimens were seen by us.

Syngrapha alias (Ottolengui)

Figure 213

Autographa alias Ottolengui, 1902, p. 69.

Syngrapha alias: Hampson, 1913, p. 424.

Autographa alias: Barnes and McDunnough, 1917, p. 83.

Autographa interalia Ottolengui, 1919, p. 122.—McDunnough, 1938, p. 113.

Syngrapha alias: McDunnough, 1944, p. 189.

Male genitalia (fig. 78).—Tegumen about one-half length of valve; uncus broad, shorter than tegumen; valve narrow near middle, widest in apical one-fifth, sacculus near base of valve produced into a triangular-shaped protuberance, which is broad at base and round at apex; clavus typical for genus, ampulla reduced to short stub with apex variable, sometimes blunt, or pointed, or blunt with a minute spine; aedeagus with a single apical cornutus on vesica, which is thick at base, sharply curved and tapered to a point, and aedeagus basad with vesica granulate.

Female genitalia (fig. 130).—Ostium bursae in two distinct parts; the caudal portion short and wide, slightly wider than long, sclerotized and strigate, and the second portion slightly longer and narrower than caudal portion, rounded at base, and produced on right side as a short rounded appendage; ductus bursae mostly membranous initially, becoming more sclerotized and strigate, entering corpus bursae on right side where it is wider than one-fifth, but no more than one-half of the total length of the ductus bursae; corpus bursae membranous, sac-like shagreened at apex from which ductus seminalis arises.

Larvae.—Crochets range from 25 to 27 in number; microspines of integument present; interval between the pinacula of setae V-1 on abdominal segment 4 more than one-half the interval between V-1 and SV-2; otherwise similar to *celsa*, which also has raduloid absent.

Type.—Male, American Museum of Natural History (*alias*). Female, American Museum of Natural History (*interalia*).

Type locality.—Jefferson, N. H. (*alias*). Nordegg, Alberta (*interalia*).

Host plant.—*Picea engelmanni*, *P. glauca*, Ross and Evans (1957); *Abies amabilis*, *A. balsamea*, *A. lasiocarpa*, *Latrix laricina*, *Picea mariana*, *P. rubens*, *Pinus banksiana*, *P. monticola*, *Pseudotsuga menziesii*, *Thuja plicata*, *Tsuga heterophylla*, Prentice (1962).

Range (map 14).—Newfoundland to Alaska; south to New York, Wisconsin, and California; Rocky Mountains south to Arizona.

Comments.—The specimens studied here agree with the type examined in the American Museum of Natural History. The type of *inter-*

alia, a female, was examined and determined to be *alias*. Parental female of laboratory culture was collected in Schoolcraft County, near Manistique, Mich. Other larvae were provided by A. H. Rose, Canada Department of Forestry, Sault Sainte Marie, Ontario.

Syngrapha abstrusa n. sp.

Figure 214

This species, like *cryptica*, is related to *alias*, which is the predominant species in those collections examined to date. The existence of *abstrusa* as a distinct species and not as part of the inherent variability of *alias* was discovered by examination of the male genitalia.

Adult description.—Primaries basically gray, darkest in median area, dark gray mixed with dark brown, dark area extending outward to postmedial (pm.) line, in some specimens slightly obscuring line, and basad to antemedial (am.) line, becoming slightly lighter gray with black specks to inner margin; above median dark area, becoming slightly lighter gray, lightest around orbicular and on distal side of pm. line; basal third between am. line and basal line (b.l.), gray with small amounts of silver or gold scales. Fringe white, alternating with dark gray bars; terminal line (t.l.), forming white crescents, the points of which join at bases of bars on fringe, except at apex of wing where it fades out; subterminal (st.) line black almost to anal angle, thinly bordered on outer side with white, becoming mostly white only near anal angle, costal portion wavy, incised above M_2 , then irregularly dentate, curving outward to margin just above fringe of scales on anal angle; pm. line silvered throughout, bordered with black, concave opposite cell and fold, incurved to costa; am. line and b.l. silvered and wavy. Reniform elongate oval with black outline thin or faded out at top and bottom, somewhat silvered on both sides; orbicular outlined in silver, surrounded by light gray area, dark in the center; stigma variable, irregular in shape, thickly outlined in silver, dark in the center, expanded on lower, inner side as a silver spot, with another silver spot on lower, outer side completely separated from stigma in all specimens so far examined.

Secondaries dull luteous, basal half or less heavily shaded, fuscous, with a somewhat contrastingly lighter, narrow band between; fringe white with some fuscous bands.

Length of primaries from wing base along costa to apex: 14 ± 1.0 mm (10 specimens).

Male genitalia (fig. 64).—Tegumen about one-half length of valve; uncus shorter than tegumen, thick, produced as a sharp spine at apex; juxta not produced at apex into a distinct, sclerotized spine; valve tapering somewhat at tip to a rounded apex, with clavus broad at base, short, narrowing to blunt, setose apex; sacculus at base smoothly rounded, not produced into a broad, somewhat triangular protuberance as with *alias*; ampulla arising from a broad base, tapering to a sharp point, and not extending to costal margin; aedeagus with a single apical cornutus on vesica, which is thick at base, sharply curved, and tapered to a point, aedeagus basad with vesica granulose.

Female genitalia (fig. 145).—Ostium bursae in two distinct parts, the caudal portion about as wide as long, sclerotized and strigate, and the second portion narrower at origin, sclerotized, widening to base where it is rounded, and produced on the right side as a round projection (may be appressed to ostium bursae in some preparations); ductus bursae about one-half width of ostium bursae, sclerotized and strigate throughout, only slightly wider at entrance to corpus bursae, about one-fifth of its total length; corpus bursae membranous, saclike, shagreened at apex from which ductus seminalis arises.

Type.—Holotype, male, Lake Katherine, Oneida County, Wis., July 4, 1938; genitalia slide AU#051; deposited in Los Angeles County Museum of Natural History, Los Angeles, Calif.

Allotype, female, same as type, H. M. Bower; genitalia slide AU#053; deposited in Los Angeles County Museum of Natural History, Los Angeles, Calif.

Paratypes, two males, one female from Rainbow Falls Park near Rossport, Thunder Bay County, Ontario, M. C. Nielson, deposited in Michigan State University, East Lansing; one male from Jefferson's Notch, near Jefferson, N.H., T. D. Eichlin, deposited in National Museum of Natural History, Washington, D.C.

Host plant.—Unknown; probably some host records for *alias* should apply to *abstrusa*.

Range (map 2).—Ontario, Maine, New Hampshire, Michigan, and Wisconsin.

Comments.—The italicized phrase in the preceding adult description should enable one to select suspects of this species from a mixed series containing *alias* and *cryptica*, but definitive identification must be made by examination of genitalic characters.

Syngrapha cryptica n. sp.

Figure 215

This species, like *abstrusa*, is related to *alias*. The existence of *cryptica* as a distinct species, and not as part of the inherent variability in the maculation of *alias*, was discovered by examination of the male genitalia. The following differences in wing patterns were subsequently noted.

Adult description.—Primaries basically brown, darkest in median area, dark area extending outward, slightly across pm. line, partially obscuring line, and basad to am. line, becoming gray-brown, flecked with black specks to inner margin; *above medial dark area, becoming light brown, slightly lighter mixed with gray in some specimens just distad of pm. line; basal one-third between am. line and b.l. may be silver-gray or gold tinged with green or yellow; a somewhat rectangular patch of slightly iridescent, silver-gray or a shade of gold, corresponding roughly to basal hue of that particular specimen, extending from vein M_2 almost to anal angle, and extending basad from t.l. to just beyond st. line; dark scales on veins in the latter area may show as thin, dark, straight streaks, particularly on M_3 and Cu_2 and on M_2 and Cu_1 on some specimens.*

Fringe white, alternating with dark gray bars; t.l. forming white crescents, the points of which join at bases of bars on fringe, except at apex of wing where it is dark gray and incurved to costal margin; st. line with costal one-half either entirely black or with a thin border of silver distad, becoming mostly silver toward inner margin as it passes through iridescent area, costal portion wavy, incised above M_2 , then irregularly dentate, curving outward to

margin just above fringe of scales at anal angle; pm. line unsilvered, light brown, outline fuscous for costal half, becoming somewhat silvered for inner one-half to margin, concave opposite cell and fold, incurved to costa; am. line and b.l. silvered and wavy. Reniform narrow, approximating a parallelogram, outlined in black with at most a few silver scales intermixed; orbicular outlined in silver, dark brown in the center; stigma variable, irregular in shape, thickly outlined in silver with dark brown in the center, extended on its lower two corners in rounded, silver spots, variable in size, the outer one of which may be disjoined as a separate spot on one or both wings. Secondaries dull luteous, basal one-half heavily shaded, fuscous, with somewhat contrastingly lighter, narrow band between; fringe white with fuscous bands.

Length of primaries from wing base along costa to apex: 16.5 ± 1.5 mm (12 specimens).

Male genitalia (fig. 71).—Tegumen less than one-half length of valve; uncus shorter than tegumen, thick, produced as a sharp, curved spine at apex; juxta without sclerotized apical spine; valve widest in apical one-fifth, narrowed toward middle, with clavus broad at base, short, narrowing to blunt, setose apex, sacculus at base not produced into a broad, somewhat triangular protuberance as with *alias*, and ampulla represented by a broad, short ridge with truncate apex and no apical spine; aedeagus with a single apical cornutus on vesica, which is thick at base, sharply curved, and tapered to a point, and aedeagus basad with vesica granulose.

Female genitalia (fig. 147).—Ostium bursae in two distinct parts, the caudal portion short and wide, slightly wider than long, sclerotized and strigate, and the second portion narrower at origin, sclerotized, becoming as wide as caudal portion of ostium bursae, rounded cephalad and produced on right side as a short, round appendage near base of cephalic portion of ostium bursae; ductus bursae at origin mostly membranous, about one-half the width of ostium bursae, gradually widening and becoming more sclerotized and strigate to entrance into corpus bursae on right side, at which point the ductus bursae is wider than one-half of its total length; corpus bursae membranous, saclike, sha-

greened at apex from which ductus seminalis arises.

Type.—Holotype, male, Lake Katherine, Oneida County, Wis., July 13, 1946, H. M. Bower; genitalia slide AU#059; deposited in Los Angeles County Museum of Natural History, Los Angeles, Calif.

Allotype, female, same as above, H. M. Bower; genitalia slide AU#062; deposited in Los Angeles County Museum of Natural History, Los Angeles, Calif.

Paratypes, two males, one female, Roscommon County, Mich., V. Warczunski, deposited in Michigan State University, East Lansing; one male, Wausau, Wis. and two males, two females from type locality, H. M. Bower, deposited in Los Angeles County Museum, Los Angeles, Calif.

Host plant.—Unknown.

Range (map 1).—Wisconsin, Michigan, and New Hampshire.

Comments.—The italicized passages in the preceding description indicate diagnostically significant characters differing from the outer species of the *alias* complex, *alias* and *abstrusa*.

Syngrapha rectangulara (Kirby)

Figure 216

Plusia rectangulara Kirby, 1837, p. 306.

Autographa rectangulara: Ottolengui, 1902, p. 68 and *mortuorum* (Guenee), 1852, p. 353.

Syngrapha rectangulara: Hampson, 1913, p. 423.

Autographa rectangulara: Barnes and McDunnough, 1917, p. 83.

Autographa rectangulara race *nargenta* Ottolengui, 1919, p. 122.

Syngrapha rectangulara: McDunnough, 1944, p. 188.

Male genitalia (fig. 77).—Similar to *alias*, except that *rectangulara* does not have the sacculus produced mesad as a broad triangular projection.

Female genitalia (fig. 133).—Same as for *alias* with the following exceptions: The small projection to the right at the base of the ostium bursae is membranous; in all specimens studied the ductus bursae enters the corpus bursae about one-fourth of the total length of corpus

bursae cephalad of corpus bursae apex, but in *alias* it enters about one-third of total length of corpus bursae cephalad of corpus bursae apex, perhaps being subject to more variation than has been observed in this study.

Larvae.—Refer to description of *alias* to which *rectangulara* is similar.

Type.—[?] British Museum (Natural History) (*rectangulara*). Syntypes, American Museum of Natural History (*nargenta*). British Museum (Natural History) (*mortuorum*).

Type locality.—Canada (*rectangulara*). Kaslo and Vancouver, British Columbia (*nargenta*). New York (*mortuorum*).

Host plant.—*Pseudotsuga menziesii*, Crumb (1956); *Abies lasiocarpa*, *Picea engelmanni*, *Pinus monticola*, *Tsuga heterophylla*, Ross and Evans (1957); *Abies amabilis*, *A. grandis*, *Larix laricina*, *Picea rubens*, *P. stichensis*, *Tsuga mertensiana*, Prentice (1962); *Abies balsamea*, *Picea glauca*, *P. mariana*, Tietz (1972).

Range (map 19).—Nova Scotia to British Columbia; south to Pennsylvania and west to Washington.

Comments.—Ova were obtained from females collected at black lights in Lincoln, Me., Stratford, N. H.; and Manistique, Mich., but the larvae on artificial diet fed very little and died as first or second instar larvae. Larvae were provided by A. H. Rose, Canada Department of Forestry, Sault Sainte Marie, Ontario.

Syngrapha angulidens (Smith)

Figure 217

Plusia angulidens Smith, 1891, pp. 111, 112.

Autographa angulidens: Dyar, 1902, p. 81.

Syngrapha angulidens: Hampson, 1913, pp. 427, 428.

Autographa angulidens: Barnes and McDunnough, 1917, p. 83.

Syngrapha angulidens var. *excelsa* (Ottolengui) 1902, pp. 71, 72.—McDunnough, 1944, pp. 191, 192.

Male genitalia (fig. 76).—Valve with ampulla arising from broad base, tapering to a pointed apex, the length and shape of ampulla apparently variable; juxta produced to a strong, sharp point apically, aedeagus with an apical

cornutus about one-third as long as aedeagus, and with a much smaller basal cornutus.

Female genitalia (fig. 126).—Similar to *celsa* but with membranous projection off base of ostium bursae shorter and produced laterad, not directed caudad; overall size of genitalia smaller than *celsa*.

Type.—Lectotype female, National Museum of Natural History (*angulidens*), designated by Todd (1972). Female, American Museum of Natural History (*excelsa*).

Type locality.—Colorado (*angulidens*). Jefferson, N. H. (*excelsa*).

Host plant.—*Abies lasiocarpa*, Ross and Evans (1957).

Range (map 18).—Nova Scotia, south to New Hampshire; Rocky Mountains in Canada, south to Arizona.

Syngrapha celsa (Edwards)

Figure 218

Plusia celsa Edwards, 1881, p. 101.

Autographa celsa: Dyar, 1902, p. 81.

Syngrapha celsa: Hampson, 1913, pp. 422, 423.

Autographa celsa race *sierrae* Ottolengui, 1919, p. 123.

Syngrapha celsa: McDunnough, 1944, p. 189.

Male genitalia (fig. 61).—Similar to *angulidens*, but with ampulla on valve shorter on all specimens examined, abruptly narrowed at apex, or stubby with tiny, apical wart or spine; juxta only slightly produced to an apical point at best; apex of aedeagus heavily spiculate, but only weakly spiculate and more granulose in *angulidens*.

Female genitalia (fig. 124).—Ostium bursae about equal length to the ductus bursae, well sclerotized, tapering toward the base from which is produced a membranous, fingerlike process to the right and directed caudad; the ductus bursae sclerotized and strigate, entering the corpus bursae on right side about half way from apex; corpus bursae minutely granulose, becoming more concentrated on the extended, much darkened apex; ductus seminalis originates on dorsal side of the rounded apex.

Larvae.—Integument thickly covered with dark microspines, which form middorsal and subdorsal longitudinal bands; crochets range

from 25 to 28 in number; seta SV-2 on abdominal segment 1; seta SV-2 on meso- and meta-thorax; mesothorax with pinaculum of D-2 equidistant from D-1 and SD-2; pinacula and area surrounding base of seta dark; raduloid of hypopharynx absent.

Type.—A male syntype of *celsa* in the National Museum of Natural History has been selected and labeled and is presently designated as the lectotype: "*Plusia celsa* Hy. Ed., Type/Collection Brklyn. Mus./Type No. 34106, U.S.N.M./Col. B. Neumoegen/♂ genitalia on slide, Aug. 19, 1936, J.F.G.C. #535." Female, American Museum of Natural History (*sierrae*).

Type locality.—Mount Hood, Oreg. (*celsa*). Lake Tahoe, Calif. (*sierrae*).

Host plant.—*Abies grandis*, *A. lasiocarpa*, Crumb (1956); *Picea glauca*, *Tsuga heterophylla*, Ross and Evans (1957); *Picea engelmannii*, *Pinus monticola*, Prentice (1962).

Range (map 13).—Alaska; south to California and Utah.

Comments.—The adult specimens studied agreed with the type of "*sierrae*" examined in the collection of the American Museum of Natural History and *celsa* in the National Museum of Natural History. Larvae of this species were collected by investigators in the field in the Canada Department of Agriculture, British Columbia. Larvae were reared to adults for identification and association with larval specimens. The specimens were obtained from D. A. Ross and B. A. Sugden.

Syngrapha montana (Packard)

Figure 219

Plusia montana Packard, 1874b, p. 313.

Autographa montana: Barnes and Benjamin, 1923, p. 213.

Syngrapha montana: Ferguson, 1955, pp. 23–27.

Male genitalia (fig. 65).—Similar to *microgamma*, but with clavus tapering to a narrowly rounded apex in all specimens examined; juxta without sclerotized, apical spine; aedeagus only slightly spiculate apically, and with apical cornutus longer and thinner than that of *microgamma*.

Female genitalia (fig. 129).—Ostium bursae small, about as long as wide; ductus bursae

straight, strigate, but mostly membranous, entering corpus bursae on the right side well beyond apex at about the middle of corpus bursae; apex of corpus bursae granulose and darkly pigmented around base of ductus seminalis.

Type.—Lost (Ferguson, 1955).

Type locality.—White Mountains, N. H.

Host plant.—Unknown.

Range (map 19).—Nova Scotia to Saskatchewan; Maine, New Hampshire, and Wisconsin.

Syngrapha microgamma (Hübner)

Figure 220

Noctua microgamma Hübner, 1823, p. 151, figs. 698, 699.

Plusia microgamma: Treitschke, 1823, p. 198.

Syngrapha microgamma: Dod, 1910b, p. 118.

Autographa microgamma: Strand, 1916, p. 47.

Autographa montana (Packard), 1874b, p. 313.—Barnes and Benjamin, 1923, p. 213.

Syngrapha microgamma: McDunnough, 1944, p. 184.

Male genitalia (fig. 18).—Ampulla on valva broad basally, then narrow and tapered to a point in apical third; clavus short and broad; juxta with a distinct, sclerotized, sharp, apical spine; aedeagus spiculate apically, with a strong apical cornutus and a small basal cornutus.

Female genitalia (fig. 138).—Ostium bursae small about as wide as long, sclerotized but incompletely on venter; posterior two-thirds of ductus bursae sclerotized, swollen on the right cephalad before becoming strigate as it enters the corpus bursae on the left side; an additional membranous bulge is over the swollen area on the ductus bursae; the apex of the corpus bursae shagreened and darkly pigmented.

Larvae.—Integument with microspines except on the spiracular line; crochets range from 24 to 26 in number; interval between the pinacula of setae V-1 on abdominal segment 4 one-half the interval between V-1 and SV-2; otherwise similar to *celsa*, which also lacks a raduloid.

Type.—[?].

Type locality.—[?].

Host plant.—Unknown in North America; in Europe feeds on *Salix myrtilloides* and *S. rosmarinifolia*, Kostrowicki (1961).

Range (map 12).—Nova Scotia west to British Columbia and north to Yukon Territory; south to Maine, New Hampshire, Michigan, Wisconsin, and Colorado.

Comments.—Parental females of laboratory cultures were collected while they flew during daylight hours over sphagnum-heath bogs in Schoolcraft County, near Manistique, Mich. Although adults were common in these situations, they were elusive and difficult to capture.

Syngrapha alticola (Walker)

Figure 221

Plusia alticola Walker, 1857, p. 912.

Plusia alticola Walker, Packard, 1974a, p. 554. [= *hochenwarthi*]

Plusia ignea Grote, 1863, p. 274.—Grote, 1874a, p. 31.

Syngrapha alticola (Walker), Ottolengui, 1902, p. 63. [= *devergens*]

Plusia alticola: Hampson, 1908, p. 106.

Caloplusia alticola: Hampson, 1913, p. 407.

Syngrapha alticola: Dod, 1913, p. 241.

Syngrapha alticola (Walker), McDunnough, 1938, p. 112. [= *devergens*]

Syngrapha alticola: McDunnough, 1944, p. 182.

Male genitalia (fig. 75).—Valve with ampulla arising from a broad base, tapering to near costal margin, with a small, sharp, terminal spine projecting just over costal margin; juxta with a distinct, sclerotized, sharp, apical spine; aedeagus without cornuti.

Female genitalia (fig. 128).—Ostium bursae subcylindrical, slightly longer than wide, weakly sclerotized; ostium with a thick, circular, membranous, pouchlike structure on each side; ductus bursae mostly membranous and granular, except for some sclerotization near entrance to corpus bursae, bending somewhat to the left in the middle, about one-half the width and twice the length of ostium bursae, widening slightly where it enters corpus bursae on the right side; corpus bursae somewhat J-shaped from ventral aspect, with the cephalic

end tapering to a point, and the apex of uniform diameter, granulose, rounded caudad, with the ductus seminalis arising in the center of apex.

Type.—Male, British Museum (Natural History) (*alticola*). [?] (*devergens*).

Type locality.—Rocky Mountains (*alticola*). [?] (*devergens*).

Host plant.—Unknown.

Range (map 14).—Manitoba west to Alaska, British Columbia; south to Montana, Wyoming, and Colorado, with isolated records in Sierra Nevadas of California.

Syngrapha parilis (Hübner)

Figure 222

Noctua Parilis Hübner, [1808–1809], pl. 90, fig. 422.

Autographa parilis: Hübner, 1816, p. 251.

Plusia parilis: Boisduval, 1829, p. 251.

Plusia quadriplaga Walker, 1857, pp. 911, 912.—Smith, 1893, p. 256.

Syngrapha parilis: Dyar, 1902, p. 82.

Autographa parilis: Hampson, 1913, pp. 404, 405.

Syngrapha parilis: McDunnough, 1916, p. 400.

Male genitalia (fig. 67).—Similar to *alticola*, but apex of ampulla does not appear to have a distinct spine, and the juxta is produced apically into a strong point, but not a distinct sclerotized spine.

Female genitalia (fig. 152).—Ostium bursae short, about as wide as long; ostium unprotected; initial one-half of ductus bursae membranous and granulose, the extreme caudal portion curved sharply to the right, then abruptly widened, then curved back left and becomes wider, strigate, and sclerotized as it enters the corpus bursae ventrad toward the left side; the corpus bursae dorsoventrally flattened and approximately L-shaped in ventral aspect, rounded on the cephalic end, and tapered to a blunt point at apex, from which the ductus seminalis arises; corpus bursae uniformly, minutely granulose.

Larvae.—Crochets range from 21 to 23 in number; microspines of integument present, except on spiracular line and small longitudinal

bands including setae D-1; interval between the pinacula of setae V-1 on abdominal segment 4 about subequal to interval between V-1 and SV-2; all setae black; head brown, somewhat mottled; otherwise similar to *celsa*, which also has the raduloid absent.

Type.—[?] British Museum (Natural History) (*parilis*). Female, British Museum (Natural History) (*quadriplaga*).

Type locality.—[?] (*parilis*). Fraw Islands, Arctic North America (*quadriplaga*).

Host plant.—Unknown.

Range (map 11).—Arctic south to Labrador in the East, and Alberta and British Columbia in the West.

Comments.—The larvae were borrowed from the Canadian National Collection. These were the same specimens used by MacKay (1972) in her description of the larval form of *parilis*. Based on characters examined in this study, the larvae of *parilis*, *rectangula*, *alias*, and *celsa* could not be separated.

Syngrapha ignea (Grote)

Figure 223

Plusia ignea Grote, 1863, p. 274.

Plusia ignea: Grote, 1874a, p. 31. [= *alticola*]

Syngrapha ignea: Ottolengui, 1902, p. 76.

Caloptusia ignea: Hampson, 1913, pp. 409, 410.

Syngrapha ignea: McDunnough, 1916, p. 400.

Syngrapha ignea: McDunnough, 1938, p. 113. [= *hoehenwarthi*]

Caloptusia ignea: McDunnough, 1944, pp. 178, 179, and var. *simulans* McDunnough.

Male genitalia (fig. 63).—Valve rounded at apex; ampulla thick, sharply pointed and strongly curved, apex projecting ventrocaudad; juxta with large, sclerotized, apical spine; aedeagus with a small, sclerotized, basal, spinose plate, and a larger, rounded apical plate, from which project several small cornuti.

Female genitalia (fig. 19).—Ostium bursae about twice as long as wide, sclerotized, and somewhat strigate; ostium unprotected; ductus bursae mostly membranous and granulose except just prior to entering corpus bursae where it becomes strigate and sclerotized as it enters the corpus bursae on the right side; corpus

bursae lightly shagreened with the caudoven-
tral edge of the apex heavily pigmented.

Type.—[?] (*igneae*). Male, Canadian National
Collection, Ottawa, Ontario (*simulans*).

Type locality.—Pike's Peak (*igneae*). Rocky
Bay, Quebec (*simulans*).

Host plant.—Unknown in North America;
hosts for European *hochenwarthi* (Hochen-
warth) include *Umbelliferae* spp., Kostrowicki
(1961); *Antennaria dioica*, *Carex filifolia*, *Castil-
leja lemmonii*, *Gentiana newberryi*, *Mimulus
primuloides*, *Penstemon confertus*, *Salix* sp.,
Vaccinium sp., Tietz (1972).

Range (map 13).—Newfoundland to Alaska;
south to California and Colorado.

Chrysaspidia Hübner

Generotype.—*Noctua festucae* Linnaeus, 1758.
Designated by Grote, 1895a, p. 417.

Chrysaspidia Hübner, 1821, p. 252.

Euchalcia Dyar (*nec* Hübner), 1902, p. 81.

Phytometra Hampson (*nec* Haworth), 1913, p.
452 (*partim*).

Palaeoplusia Hampson, 1913, p. 581.

Chrysaspidia: McDunnough, 1944, p. 208.

This is a very homogeneous group for the
most part on the basis of larval characters and
male and female genitalia. The males of *put-
nami*, *venusta*, and *nichollae* cannot be sepa-
rated by the genitalic characters we have ex-
amined. No differentiating structures of the
female genitalia of *putnami* and *venusta* could
be found. The species do show characteristic
color patterns on the forewings, which enables
one to identify most species (see photographs).

The male genitalia are similar to the species
of *Autographa*, having long filiform clavi. The
tegumen is less than one-half as long as the
valve. The ampullae of the valves extend be-
yond the costal margin, are not spined apically,
and are generally wider than the ampullae of
the species of *Autographa*. The vinculum is
relatively long and bluntly pointed. The juxta is
strongly produced at the apex. The aedeagus is
thick, about as long as the valve, and with a
short cornutus basad.

The female genitalia has a wide ostium bur-

sae, dorsoventrally flattened, sclerotized, with
the caudal end on the venter folded and project-
ing cephalad, and dorsad with a granulose plate
extending caudad well beyond ostium. The duc-
tus bursae enters the corpus bursae on the
apex, ventrad and to the left of the origin of the
ductus seminalis. The corpus bursae is elongate
but bulbous on the cephalic end. It is membra-
nous with a darkly pigmented patch on the
dorsal surface near the middle.

The larvae of *C. putnami* and *contexta* have
been examined and no stable diagnostic charac-
ters could be found to separate them. They are
the only group having uniordinal crochets. The
crochets range from 15 to 25 in number. The
mandible is unusual, having the ventral edge
incurved, making a deep pocket near this edge
on the mesal surface, an apparent modification
for feeding on grasses.

Although the male genitalia tend to show a
close relationship to *Autographa* spp., the setal
patterns of *Chrysaspidia* larvae are very simi-
lar to *Syngrapha* spp. Seta SV-2 is present on
the abdominal segment 1, SV-2 is absent on the
meso- and metathorax, and SV-1 and SV-2
have their pinacula partially fused on abdomi-
nal segments 1-4. On the abdominal segment 4,
SV-2 is twice as far from V-1 as each of the V-
1's are to each other. On the mesothorax, D-2 is
equidistant from D-1 and SD-2. Microspines
are present on the integument. The raduloid of
the hypopharynx is not present as is the case
for certain of the *Syngrapha* species.

KEY TO THE SPECIES BASED ON MALE GENITALIA

- Costa produced apically into a distinct spine (fig. 84a)
..... *contexta*
Costa not produced apically into a spine (fig. 82a)
..... *putnami*
..... *venusta*
..... *nichollae*

No structures could be found on the male genitalia which
would differentiate the latter three species. Refer to the
plates of the adults (fig. 225, 227, 226).

KEY TO THE SPECIES BASED ON FEMALE GENITALIA

1. Dorsal, sclerotized, pigmented area of corpus bursae
somewhat circular (fig. 151). *nichollae*
Dorsal, sclerotized, pigmented area of corpus bursae
elongate (fig. 155) 2

KEY TO THE SPECIES BASED ON FEMALE
GENITALIA—Continued

2. Pigmented area approximately one-third length of corpus bursae; corpus bursae straight (fig. 154)

..... *contexta*
Pigmented area approximately one-half length of corpus bursae; cephalic half of corpus bursae curved ventrad (fig. 155) *putnami*
..... *venusta*

[For differentiation of *putnami* and *venusta* refer to plates of the adults (figs. 225, 227).]

Chrysaspidia contexta (Grote)

Figure 224

Plusia contexta Grote, 1873b, p. 193.

Euchalcia contexta: Dyar, 1902, p. 81.

Phytometra contexta: Hampson, 1913, pp. 510, 511.

Autographa contexta: McDunnough, 1916, p. 400.

Chrysaspidia contexta: McDunnough, 1944, pp. 208, 209.

Male genitalia (fig. 84).—Typical for the genus except that the valve is produced into an apical spinelike projection. Refer to the generic description.

Female genitalia (fig. 154).—Typical for the genus except that the pigmented patch on corpus bursae is elongate and narrow and only about one-third as long as corpus bursae. Refer to the generic description.

Larvae.—Refer to the generic description.

Type.—Male, British Museum (Natural History).

Type locality.—Albany, N. Y.

Host plant.—Grasses, Tietz (1972).

Range (map 16).—Quebec and Ontario; Maine, New York west to the Dakotas.

Comments.—The larvae and associated parental female were borrowed from Canadian National Collection, Ottawa, Ontario.

Chrysaspidia putnami (Grote)

Figure 225

Plusia putnami Grote, 1873a, p. 146.

Euchalcia putnami: Dyar, 1902, p. 81.

Phytometra putnami: Hampson, 1913, pp. 509, 510.

Autographa putnami: McDunnough, 1916, p. 400.

Chrysaspidia putnami: McDunnough, 1944, pp. 208, 209.

Male genitalia (fig. 82).—Typical for the genus, refer to the generic description.

Female genitalia (fig. 149).—Very similar to *venusta* having the elongate, narrow, pigmented area on corpus bursae about one-half as long as the corpus bursae. Otherwise, the female genitalia are typical for the genus. Refer to the generic description.

Larvae.—Refer to the generic description.

Type.—Male, British Museum (Natural History).

Type locality.—Albany, N. Y.

Host plant.—Grasses, Tietz (1972); sedges and *Sparganium* sp., Forbes (1954).

Range (map 17).—Nova Scotia to Alberta; Maine to Rocky Mountains, south to Virginia in the East, to Colorado in the West.

Comments.—Larvae of this species responded poorly to the artificial diet. The parental female was taken in Schoolcraft County, Manistiquie, Mich.

Chrysaspidia nichollae (Hampson)

Figure 226

Phytometra nichollae Hampson, 1913, p. 510.

Autographa nichollae: McDunnough, 1916, p. 400.

Chrysaspidia nichollae: McDunnough, 1944, pp. 208, 209.

Male genitalia (fig. 85).—Typical for the genus; refer to the generic description.

Female genitalia (fig. 151).—Pigmented area on corpus bursae circular, otherwise typical for the genus; refer to the generic description.

Type.—Female, British Museum (Natural History).

Type locality.—Pass D. Hope, British Columbia.

Host plant.—Unknown.

Range (map 17).—Alaska to northern California.

Comments.—We are unable to distinguish between *nichollae* and *putnami* on the basis of color patterns or male genitalia, but can separate them by comparing female genitalia. In a recent publication (Eichlin, 1975), *putnami* was said to occur in California. Subsequently, it was learned that this statement is incorrect; only *nichollae* occurs in the Pacific coastal regions. Apparently, the ranges of these two species do not overlap. The type specimen of the form “mendocinensis” Strand was not seen, but should, in fact, be considered a color form of *nichollae* and not *putnami* as with previous authors, based on its type locality in Mendocino County, Calif.

Chrysaspidia venusta (Walker)

Figure 227

Plusia venusta Walker, 1865, p. 836.

Plusia striatella Grote 1873b. p. 194.—Smith, 1893, p. 248.

Euchalcia venusta: Dyar, 1902, p. 81.

Paleoplusia venusta: Hampson, 1913, p. 582.

Chrysaspidia venusta: McDunnough, 1944, pp. 208, 209.

Male genitalia (fig. 86).—Typical for the genus; refer to the generic description.

Female genitalia (fig. 155).—See discussion of female genitalia under *putnami*.

Type.—Male, British Museum (Natural History) (*venusta*). Syntypes not seen by us, British Museum (Natural History) (*striatella*).

Type locality.—Orilla, Canada (*venusta*). Washington, D.C., New York, Canada (*striatella*).

Host plant.—Swamp sedges and grasses, Forbes (1954).

Range (map 17).—Nova Scotia to Alberta; south to District of Columbia and the Dakotas.

PHYLOGENY

Richards (1932), in his arrangement of the noctuid subfamilies, based on skeletal morphology of the tympanum, placed the Plusiinae as a derivative of the tropical subfamily Stictopterinae. Forbes (1954) stated that stictopterines are very closely related to plusiines and perhaps the two groups should be combined. Larvae of the Stictopterinae have many characters in common with members of the plusiine genus *Abrostola*.

Forbes (1954), utilizing both adults and larvae, and Crumb (1956), working with noctuid larvae, agreed that the Catocalinae were closely related to the Plusiinae and exhibited characters more advanced than the plusiines.

We are postulating (figs. 156 and 157) that the ancestor of the Plusiinae had the following characters: The adult had the alula of the tympanum with two small hoods. Richards (1932) says that the Plusiinae alone possesses two hoods on the tympanum, and in the genus *Abrostola*, they are smaller than in the other species of Plusiinae, indicating that *Abrostola* is the most primitive group in the subfamily. Adults were without spines on the tibiae. The fact that more primitive subfamilies, based on

additional characters, also lack tibial spines while subfamilies more advanced than plusiines have tibial spines, indicates *Abrostola* is a primitive genus in the subfamily. Males lacked a clavus. Forbes states that the clavus of male genitalia is almost limited to the more primitive Agrotinae. This character must have evolved independently in the Plusiinae.

The ancestral larval form had ventral prolegs on abdominal segments 3–6, a character common to the large majority of noctuids, and therefore considered to be primitive. Crochets were biordinal, which is typical of all but one small genus, *Chrysaspidia*, in the extant Plusiinae. This biordinal condition is rare in the other noctuid subfamilies, but occurs in the more primitive subfamily, Cuculliinae, and appears to represent another independently evolved specialization in the Plusiinae. Seta SV-2 was absent on the meso- and metathorax. The presence of SV-2 is found only in plusiines in the Noctidae, and is confined to a group of plusiines considered to be advanced, based on other characters of the larvae and adults; the absence of SV-2 on the meso- and metathorax is therefore considered to be a primitive condi-

tion in the plusiines. Seta SV-2 was absent on abdominal segment 1; pinaculum of seta D-2 closer to D-1 than SD-2 on mesothorax; pinacula of setae SV-1 and SV-2 separated on abdominal segment 2. The setal relationships are typical of the subfamilies more primitive than the plusiines. Raduloid on the hypopharynx was present, and found in other extant noctuids in only four species of Lithocodiinae (Acontiinae of Forbes), considered to be a more primitive subfamily and in *Phyprosopus callitrichoides* Grote (filament looper), a species whose placement is uncertain, Forbes putting it in Plusiinae, Crumb in Herminiinae.

The plusiines are divided into three tribes, based chiefly on the condition of the prolegs of the larvae. In Abrostolini, all the prolegs are present though slightly reduced on abdominal segment 3, which already indicates the tendency toward reduction of the prolegs and which is progressively more pronounced in the other two tribes. The Argyrogrammini have the prolegs reduced to peglike vestiges on abdominal segments 3 and 4. However, according to Ichinose (1962), a species belonging to this tribe, *Podioplusia peponis* (Fab.), has minute prolegs on abdominal segments 3 and 4 as a first-instar larva, but not on subsequent instars. This is a further indication that the reduction and eventual loss of prolegs was an evolutionary trend in the Plusiinae. The Autographini have no vestige of prolegs on abdominal segments 3 and 4.

The prototype species gave rise to the Abrostolini line. This most primitive line retained all of the ventral prolegs on the larvae. The Abrostolini consists of the genera *Abrostola* and *Mouralia*, the larvae of which are similar to each other. The most sensitive indices to the relationships among the five species in the tribe seem to be the characters of the female genitalia (see description of female genitalia for each species in the *Abrostolini* group). The *urentis* line was determined to be the most primitive, based on the fact that this line retained more of the ancestral characters than the other four species. Some specialization of both the female and male genitalia indicates that *parvala* and *microvalis* are an offshoot of the *urentis* line. *Abrostola ovalis* shows further modifications of the genitalia, the female geni-

talia particularly places it closest to the more advanced and specialized *Mouralia tinctoides* line. *Mouralia tinctoides* is the most specialized species in the Abrostolini based on several modifications of the genitalia.

A common ancestor from the *tinctoides* line gave rise to the Argyrogrammini and Autographini lines. The mandibles of the larvae became modified with ribs two and three terminating in processes before reaching the cutting margin, and the prolegs were reduced on abdominal segments 3 and 4. A split occurred in this line with the Argyrogrammini being the more primitive, having the prolegs of the larvae reduced to peglike structures lacking crochets, but totally absent in the more advanced Autographini line.

The Argyrogrammini contains three genera. The ancestral larval form of this line had the first two pairs of prolegs vestigial, and terminal processes on the ribs of the mandible; the adult males had long, lateral tufts of scales caudad on the abdomen, and a long, filiform clavus on the valve. In the genus *Argyrogramma*, the larvae have retained the mandibular processes, and the males retained the lateral, abdominal, setal tufts, indicating that this is the most primitive genus in the tribe. The females have the unusual condition of the ductus seminalis arising from the fundus of the corpus bursae, a condition found in only one other species, *Autoplusia illustrata*. Three species are in *Argyrogramma*. *Trichoplusia*, with two species, lost the mandibular processes of the larvae, and has a highly specialized ductus bursae in females, which is longer than the total length of the abdomen. In the monotypic genus *Pseudoplusia*, the larvae retained the primitive mandibular character, but the female corpus bursae has a greatly elongated apex, almost twice the length of the main body of the corpus bursae, and the males lost the lateral tufts of long scales on the abdomen. Both characters indicate that this genus is the most advanced of the Argyrogrammini.

In the Autographini, the prolegs were completely lost on abdominal segments 3 and 4. The first major branching of the Autographini line, occurred with the migration of seta SV-2 toward SV-1, to the point where their pinacula are partially fused on abdominal segment 2. In

the more primitive line, where the pinacula of the two setae are separated, setae SV-1, SV-2, and V-1 are grouped together on abdominal segment 4. This condition is considered primitive, because the arrangement of the setae is the same as it is in the *Argyrogrammini*, where the three setae are positioned around the vestigial prolegs on abdominal segments 3 and 4. The degree to which the two V-1 setae have migrated away from the SV-group and toward each other on the venter is apparently a factor of how long prolegs have been lost in the evolutionary history of a particular line. This is based upon the additional fact that in larvae of other subfamilies, where the prolegs have been lost, this same tendency of the V-1 setae to migrate mesad has been observed. Also, on those segments where prolegs are assumed to have existed on lepidopteran progenitors, these two setae are close together. On one species seen, the two V-1 setae migrated mesad, occurring close together on abdominal segment 1 and becoming progressively farther apart on segments 2-4. Mainly on this basis, *Autoplusia* is considered most primitive of this line, followed by *Rachiplusia*, then *Plusia* and *Allagrapha*.

The placement of *Autoplusia* and *Rachiplusia* is complicated by the spination found on the tibiae, a character of the most advanced plusiines. In *Autoplusia*, spines occur only on the hind tibiae, this line giving rise to *Rachiplusia* in which all tibiae are spined. The other characters of adults and larvae, which are the same as mentioned for this evolutionary line, tend to justify its placement here, assuming that tibial spining arose independently in the *Autoplusia-Rachiplusia* line.

The genus *Polychrysia* is an offshoot of the main line in which the larvae have the pinacula of SV-1 and SV-2 setae partially fused on abdominal segment 2. The setal arrangement sub-ventrad on abdominal segment 4 is primitive as with the group just discussed, and the raduloid on the larval hypopharynx has been lost.

The *Pseudeva* and *Adeva* lines probably arose from the *Polychrysia* line since all three have male genitalia which in general are structurally quite similar. The clavi of *Polychrysia* species are shorter than in species of more primitive genera and are shorter than in the species of the more advanced genus, *Autographa*. We,

therefore, interpreted the shorter clavus as a specialization in this line. The tendency in this line was toward an overall reduction in the size of the male genitalia. Species of *Pseudeva* and *Adeva* have the clavus reduced to a mere raised, setose ridge, which indicates the species in these two genera are more highly specialized than the species of *Polychrysia*. An examination of the larvae of *Pseudeva* and *Adeva* might help to clarify the relationships among the three genera.

The *Chrysanympa* and *Eosphoropteryx* lines are placed near the three preceding genera because of the general similarities of the male genitalia and upon data from the tympanal studies of Richards (1932). This arrangement is tentative pending studies of the larvae.

The next major modification leading to the *Autographa-Syngrapha* line is indicated by the evolution of seta SV-2 on abdominal segment 1 of the larvae. The *Autographa* line retained the mandibular processes on the larvae, whereas these processes were lost in the *Syngrapha-Chrysaspidia* line.

The *Autographa* line, which contains 16 species, is a homogeneous group with similar larval forms as well as similar genitalia in the males and females. The *Autographa* line is divided into two major branches based on the presence or absence of seta SV-2 on abdominal segment 1. The more primitive branch, which lacks SV-2, is subdivided into three groups.

The most primitive of these three species groups is so designated, because the larvae have retained the mandibular processes on both ribs 2 and 3. The larvae of the second branch lost the process on rib 3, and larvae comprising the third branch lost both processes, indicating that the *biloba* group is the most highly specialized of these three lines.

The most advanced major branch of the *Autographa* line, which has evolved seta SV-2 on abdominal segment 1, gave rise to the *Syngrapha-Chrysaspidia* lineage. The latter is characterized by the loss of the mandibular processes in the larvae.

The line comprising the genus *Syngrapha* includes all species with tibial spines, at least on the hind tibiae. *Syngrapha ottolenguii* is considered to be the most primitive member of the genus because the male genitalia are more

like those of *Autographa* species and especially because the length and shape of the clavus is so similar to those of that group. In the female, the genitalia structures are more like other species of *Syngrapha* than those of *Autographa*, particularly in the possession of a ventral plate beneath the ductus bursae, a character not found in any species of *Autographa*.

The other species of *Syngrapha* have a shorter, broader clavus and are divided into three groups on characters of the larvae. The most primitive condition is the absence of seta SV-2 on the meso- and metathorax. This line is further divided into three groups of species. In one group, comprised of *altera*, *octoscripta*, *epigaea*, and *selecta*, the primitive condition of a raduloid on the larval hypopharynx was retained. In the second group of this lineage, the raduloid was lost and is comprised of *viridisigma*, *orophila*, *snowi*, *sackeni*, *lula*, *borea*, *diasema*, and *falcifera*. *Syngrapha viridisigma* is similar in genitalic structures and in wing pattern to the *selecta* group and is interpreted to be the most primitive species in the group. All the species except *falcifera* are closely related, based upon similarities in wing patterns; all have yellow hind wings and similarities of the male and female genitalia. *Syngrapha falcifera* is distinctively separate from the other two groups comprising this line and difficult to place. We tentatively place it as an offshoot of the *diasema* line.

A second evolutionary line of the lineage, with reduced clavi, specialized in evolving seta SV-2 on the meso- and metathorax. This lineage further divides into two groups of species. The more primitive group, comprised of three species, retained the raduloid. *Syngrapha interrogationis* and *S. u-aureum* are closely related based on similarities in adult color pattern and structures of the male and female genitalia. *Syngrapha surena* appears to have branched off this line because the male genitalia are more like those of *interrogationis* and *u-aureum* than any other species of *Syngrapha*.

The most highly specialized group of *Syngrapha* is comprised of 11 species, all of which have lost the raduloid. The lineage is divided into three species groups. In one of these, comprised of *alias*, *abstrusa*, *cryptica*, and *rectangula*, the species are more closely related to each other

than to the other seven species based on similarity of the male and female genitalia and larval morphology. The *celsa-angulidens* group is based on the close similarity of structures in the adults. The other five species in this line are all smaller on the average than other species of *Syngrapha*, have yellow hind wings (except for *parilis*, which has white hind wings), and are very similar to each other in genitalic characters. *S. ignea* is considered to be the most specialized species, because it has evolved spines on all the tibiae and an apical plate of many cornuti on the vessica, both of which indicate specialization.

The tympanal study by Richards (1932) and other adult morphological studies served as the basis for placing the genera *Eosphoropteryx*, *Chysanympha*, *Adeva*, and *Pseudeva*, for which no larvae have been examined, in a linear order on the dendrogram.

Assuming that the proposed scheme is basically accurate, we can postulate that the subfamily had its origin in the Tropics, with its ancestral line from near the Stictopterinae and a great amount of speciation occurred as a result of the expansion into the temperate regions. The *Argyrogrammini* are tropical, with some species capable of intruding, to greater or lesser degrees, into the temperate zones, largely because of their ability to utilize a wide array of host plants. The *Autographini* species live, for the most part, in temperate zones. A large portion of the species of this tribe inhabit the more mild temperate regions, but with several species occurring in the Boreal Regions. The species of *Syngrapha* and *Chrysaspidia* have evolved in the Boreal zones, and some have been adapted to the Arctic zones.

Kostrowicki (1961, pp. 375-382) and Ichinose (1962, p. 93) also prepared phylogenetic schemes based on their studies of the Plusiinae. Although all three phylogenies were derived independently, the basic evolutionary lines are essentially the same. This is significant, because the three systems were proposed by independent investigators, studying different faunal areas, which together comprise most of the Holarctic Region, and approached the problem from somewhat different perspectives. The major criticism of the combined systems might be the lack of a thorough knowledge of the Pan-

tropical fauna. We hope, however, that this proposal for the systematic relationships of the

species will be useful as a framework for such needed future work.

CHECKLIST OF NORTH AMERICAN PLUSIINAE

ABROSTOLINI, new tribe

ABROSTOLA Ochseneimer

- urentis* Guenee—General in temperate North America
- parvula* Barnes and McDunnough—Arizona and California (low deserts)
- microvalis* Ottolengui—Texas and Arizona
- ovalis* Guenee—New England and Mid-Atlantic States

MOURALIA Walker

- tinctoides* (Guenee)—Neotropics and Subtropics

ARGYROGRAMMINI, new tribe

ARGYROGRAMMA Hübner

- verruca* (Fabricius)—Neotropics, Subtropics, and Atlantic coastal plain
- basigera* (Walker)—Atlantic and gulf coastal plains, subtropical Mexico

TRICHOPLUSIA McDunnough

- ni* (Hübner)—General in Western Hemisphere south of Arctic zones
- oxygramma* (Geyer)—Subtropical and eastern mild Temperate zones

PSEUDOPUSIA McDunnough

- inclusens* (Walker)—Tropics, Subtropics, and eastern mild Temperate zones

AUTOGRAPHINI, new tribe

AUTOPLUSIA McDunnough

- olivacea* (Skinner)—Southern coastal California
- illustrata* (Guenee)—Neotropics, subtropical Florida
- egena* (Guenee)—Neotropics, Subtropics

RACIPLUSIA Hampson

- ou* (Guenee)—Subtropical and temperate North America

PLUSIA Ochseneimer

- balluca* (Geyer)—Nearctic Boreal

ALLAGRAPHIA Franclemont

- aeroides* (Grote)—Nearctic Boreal
- areea* (Hübner)—Nearctic, east of Rocky Mountains

POLYCHRYSLA Hübner

- moneta* (Fabricius)—Holarctic
- morigera* (Edwards)—Western Nearctic Boreal

ADEVA McDunnough

- albavitta* (Ottolengui)—Mountains and deserts of Western United States

PSEUDEVA Hampson

- palligera* (Grote)—Mountains of Western United States
- purpurigera* (Walker)—Nearctic Boreal

CHRYSANYPHA Grote

- formosa* (Grote)—Nearctic Boreal

EOSPHEOPTERYX Dyar

- thyatyroides* (Guenee)—Nearctic Boreal

AUTOGRAPHIA Hübner

- precationis* (Guenee)—Temperate North America, east of Rocky Mountains
- bimaculata* (Stephens)—Nearctic Boreal
- sansoni* Dod—Western Nearctic Boreal
- rubida* Ottolengui—Nearctic Boreal
- biloba* (Stephens)—Temperate and subtropical North America
- californica* (Speyer)—Western North America
- pseudogamma* (Grote)—Nearctic Boreal
- v-alba* Ottolengui—Western Nearctic Boreal
- pasiphaeia* (Grote)—Oregon and California
- flagellum* (Walker)—Nearctic Boreal
- metallica* (Grote)—Western Nearctic Boreal
- speciosa* Ottolengui—Vancouver, British Columbia
- labrosa* (Grote)—Central coast of California
- corusca* (Strecker)—Western Nearctic Boreal
- mappa* (Grote and Robinson)—Nearctic Boreal
- ampla* (Walker)—Nearctic Boreal

SYNGRAPHIA Hübner

- ottolenguii* (Dyar)—Arctic North America
- altera* (Ottolengui)—Eastern Nearctic Boreal
- octoscripta* (Grote)—Nearctic Boreal
- epigaea* (Grote)—Nearctic Boreal
- selecta* (Walker)—Nearctic Boreal
- viridisigma* (Grote)—Nearctic Boreal
- orophila* (Hampson)—Western Nearctic Boreal
- snowi* (Edwards)—Boreal New Mexico
- sackeni* (Grote)—Boreal in Rocky Mountains
- lula* Strand—Western Nearctic Boreal
- borea* (Aurivillius)—Arctic North America
- diasema* (Boisduval)—Holarctic
- falcifera* (Kirby)—Temperate North America
- u-aureum* (Guenee)—Nearctic Boreal, Scandinavia
- interrogationis* (Linnaeus)—Holarctic
- surena* (Grote)—Eastern Nearctic Boreal
- alias* (Ottolengui)—Nearctic Boreal
- abstrusa* n. sp.—Eastern Nearctic Boreal
- cryptica* n. sp.—Eastern Nearctic Boreal
- rectangula* (Kirby)—Nearctic Boreal
- angulidens* (Smith)—Nearctic Boreal
- celsa* (Edwards)—Nearctic Boreal
- montana* (Packard)—Eastern Nearctic Boreal
- microgamma* (Hübner)—Nearctic Boreal
- alticola* (Walker)—Western Nearctic Boreal
- parilis* (Hübner)—Holarctic
- ignea* (Grote)—Nearctic Boreal

CHRYSPIDIA Hübner

- contexta* (Grote)—Eastern Nearctic Boreal
- putnami* (Grote)—Nearctic Boreal
- nichollae* (Hampson)—Coastal northwestern United States, British Columbia
- venusta* (Walker)—Mostly eastern Nearctic Boreal

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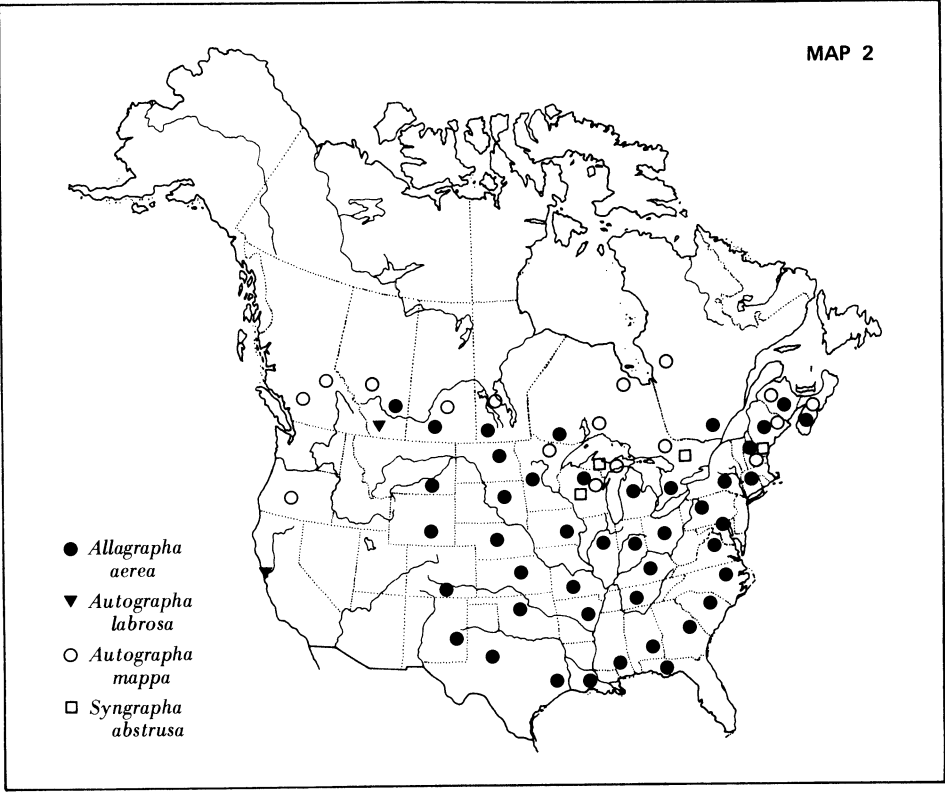
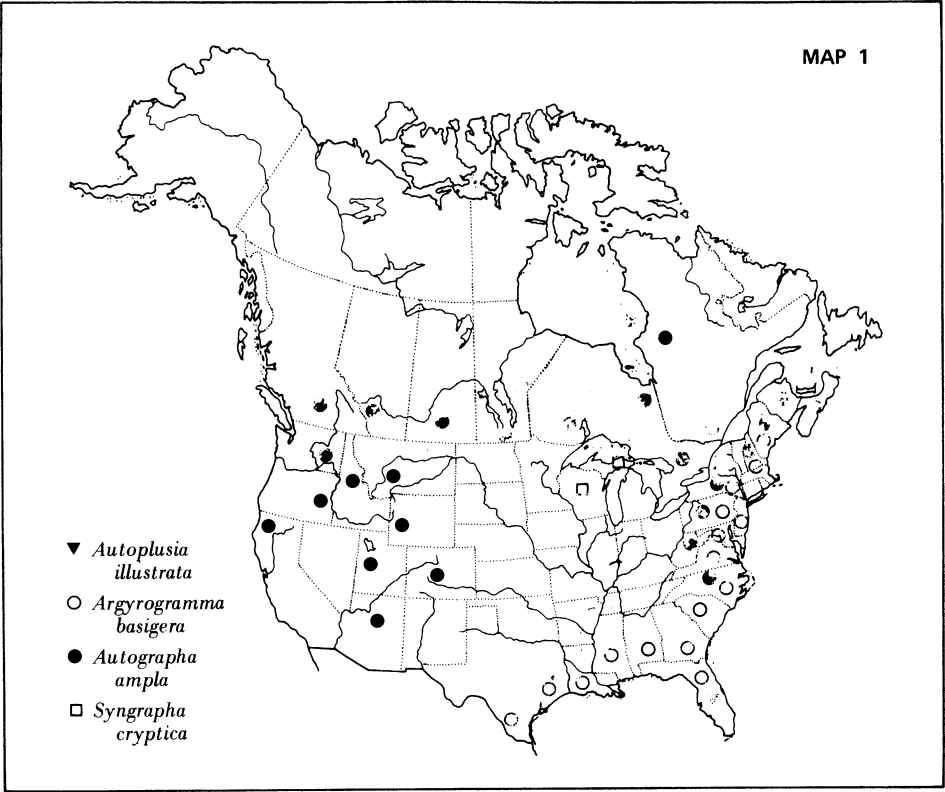
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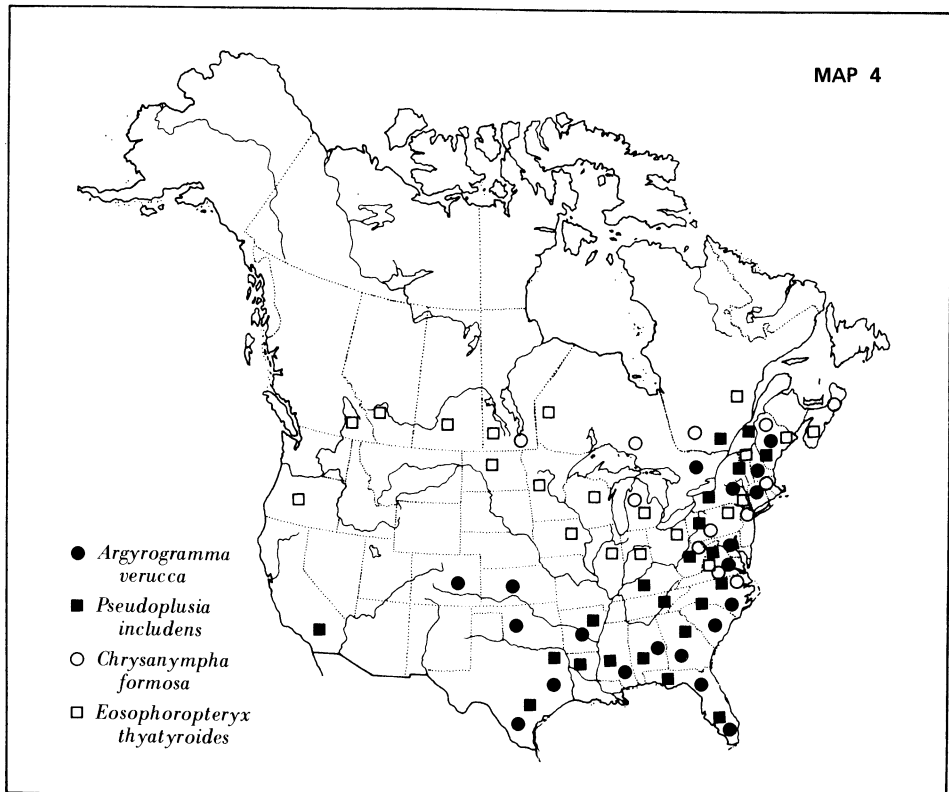
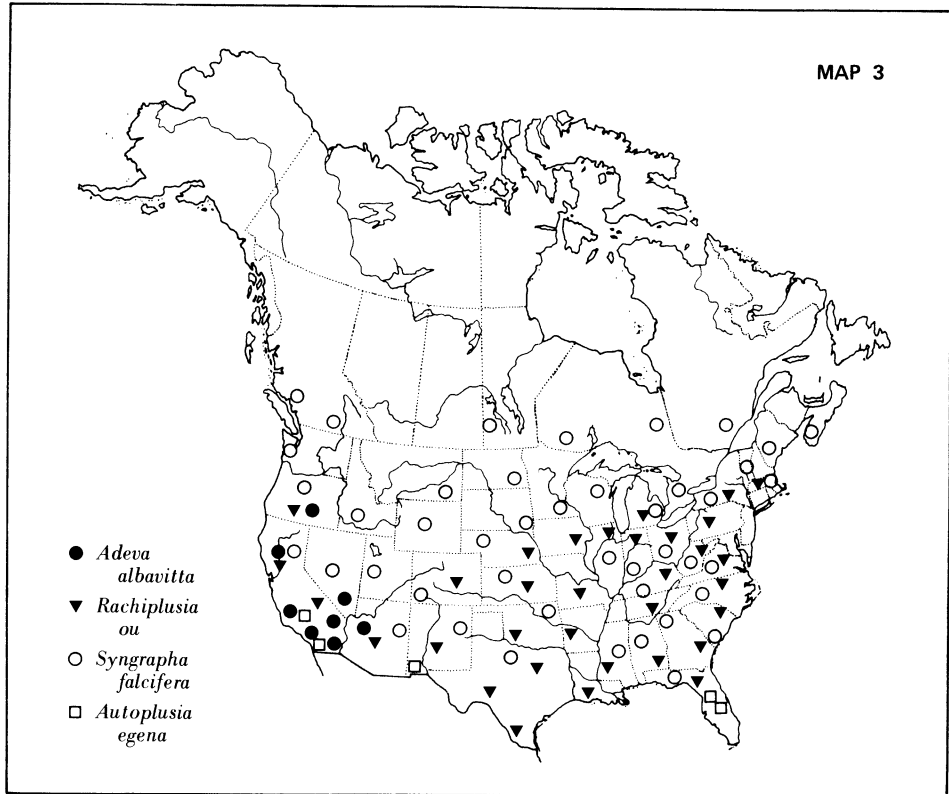
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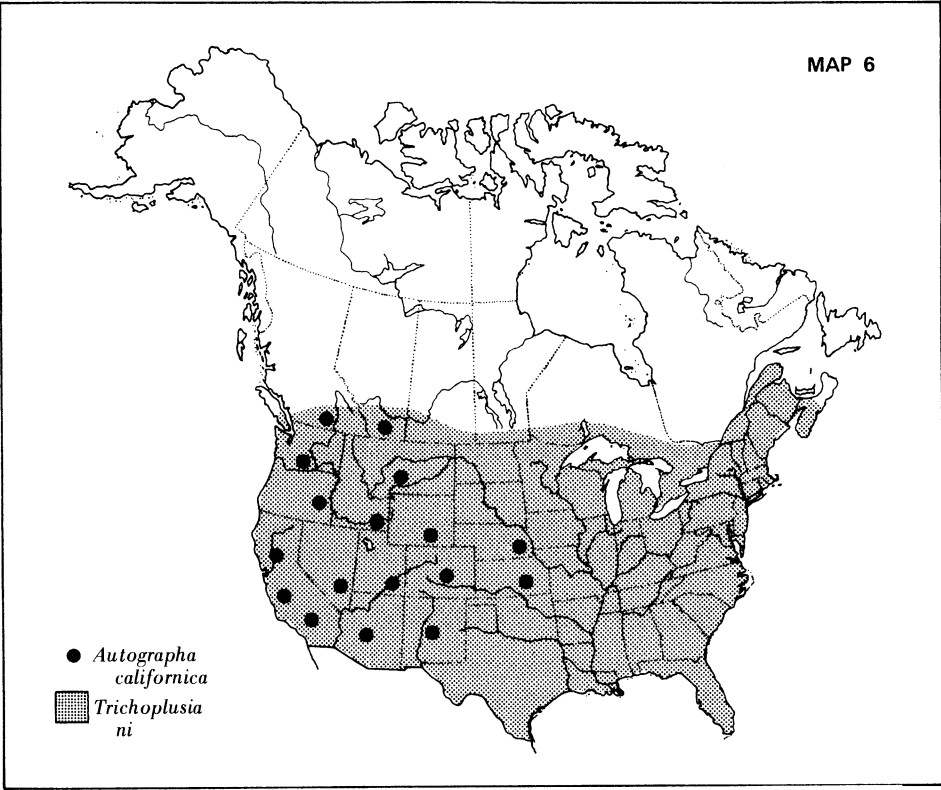
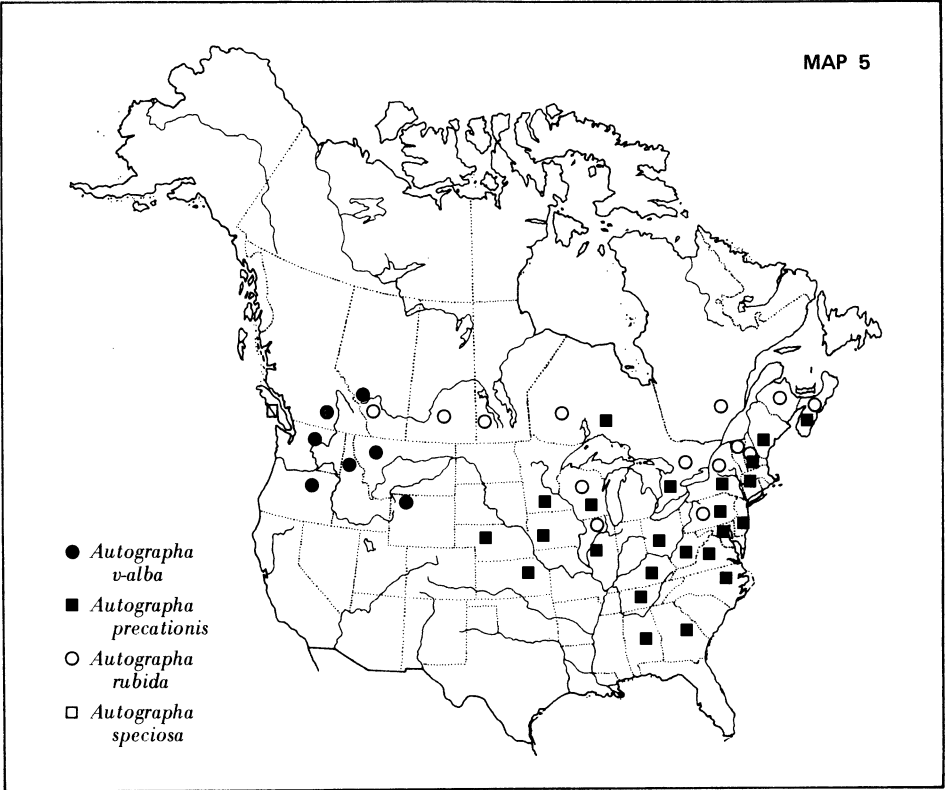
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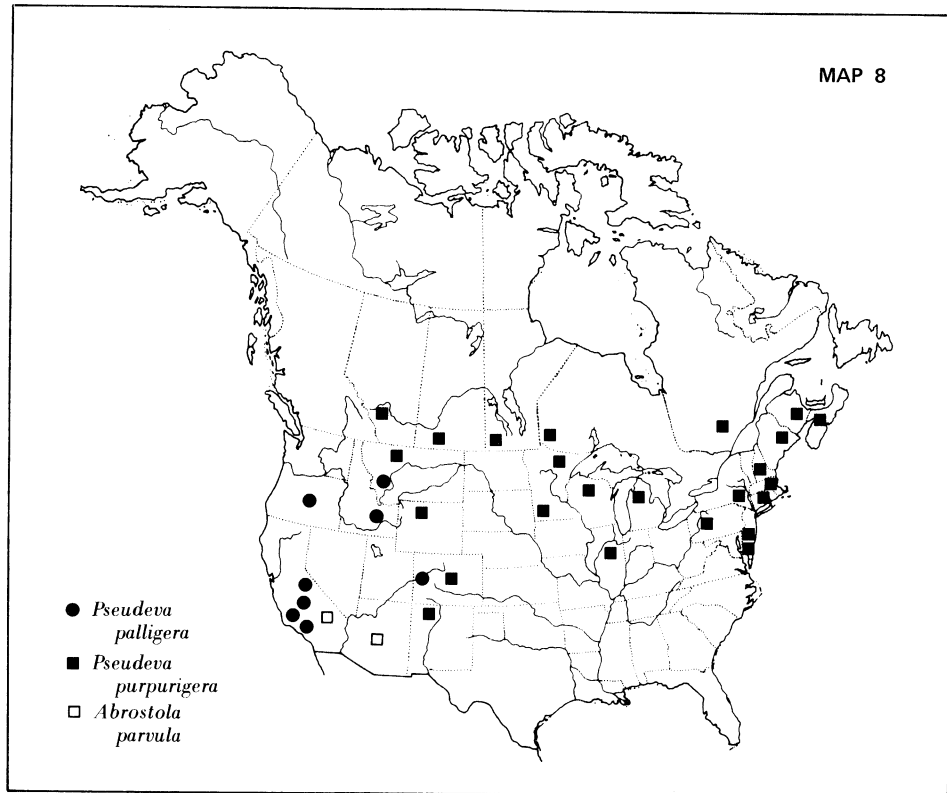
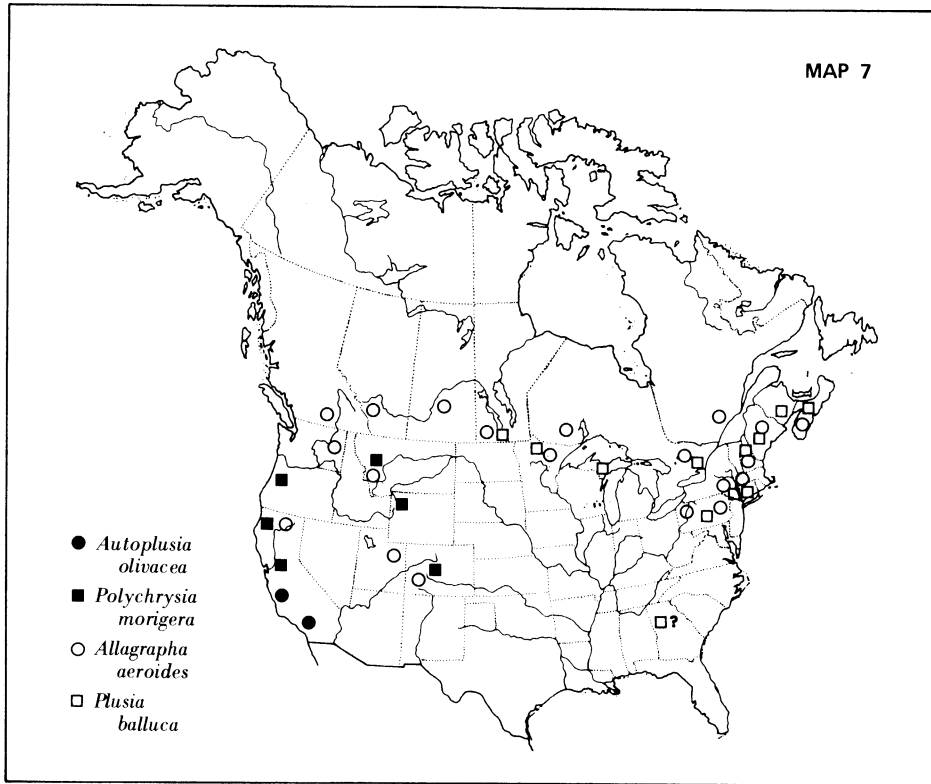
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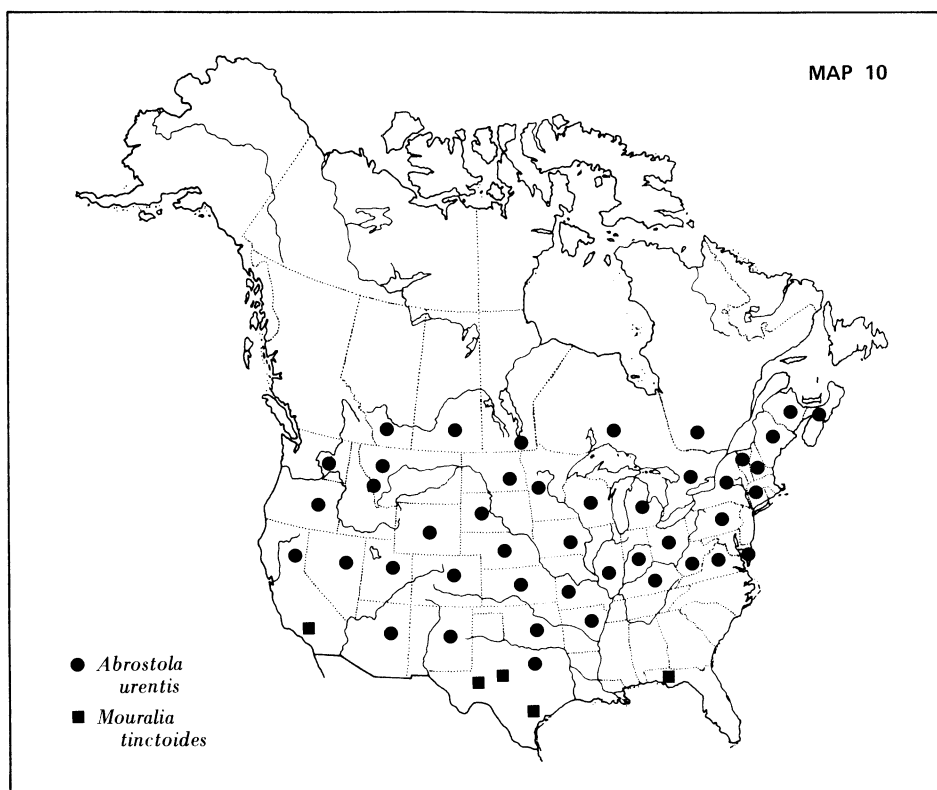
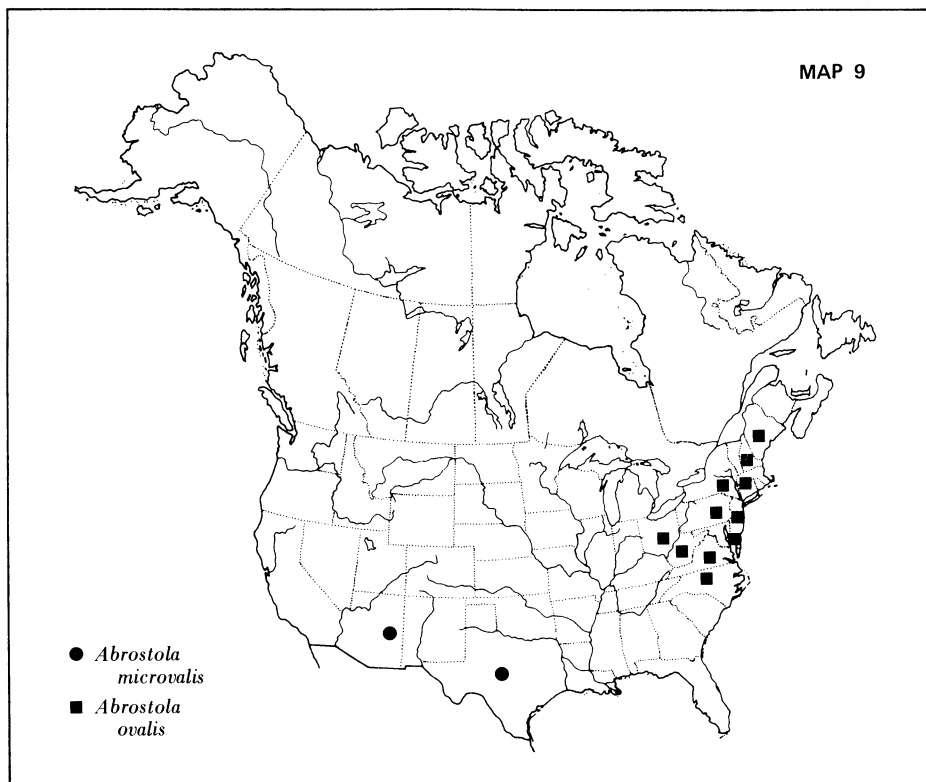
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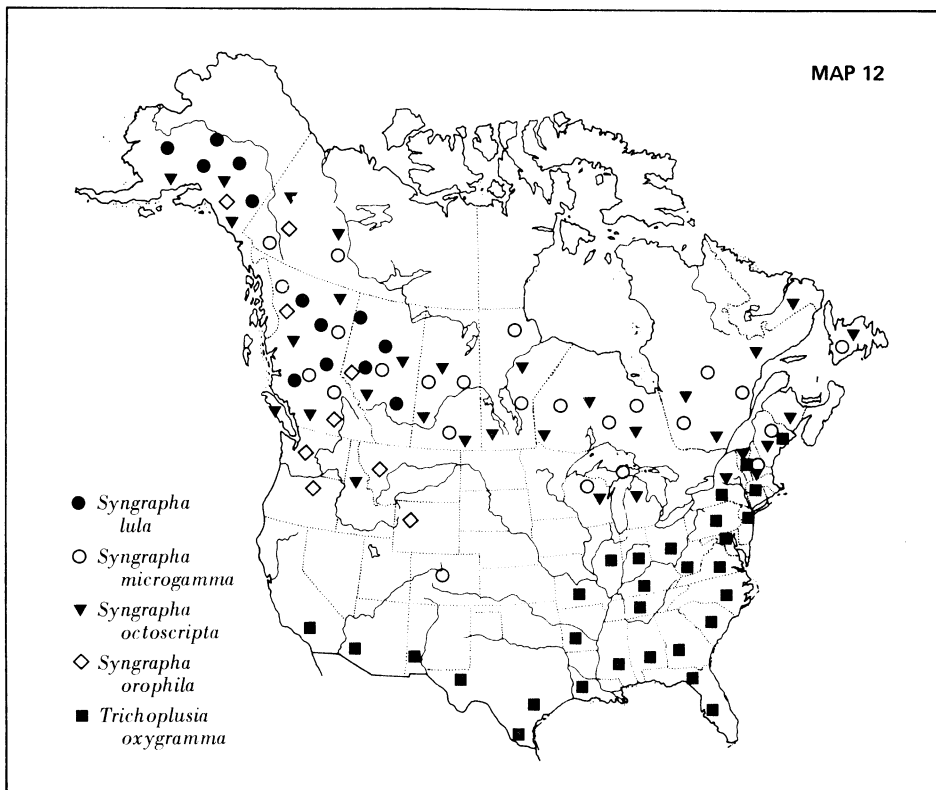
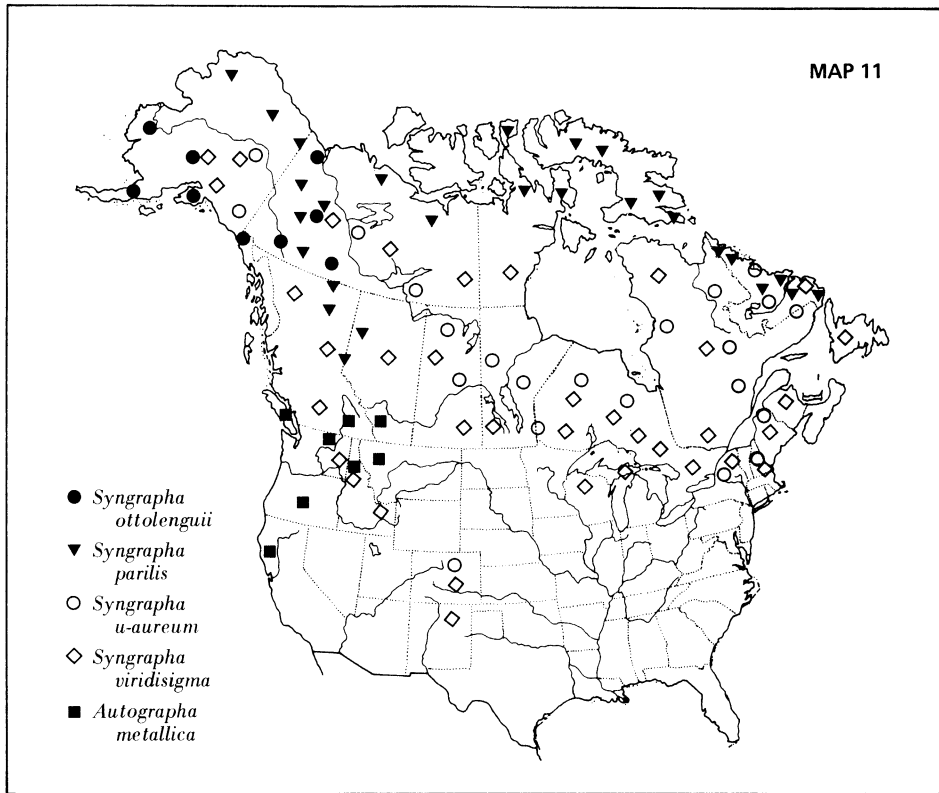


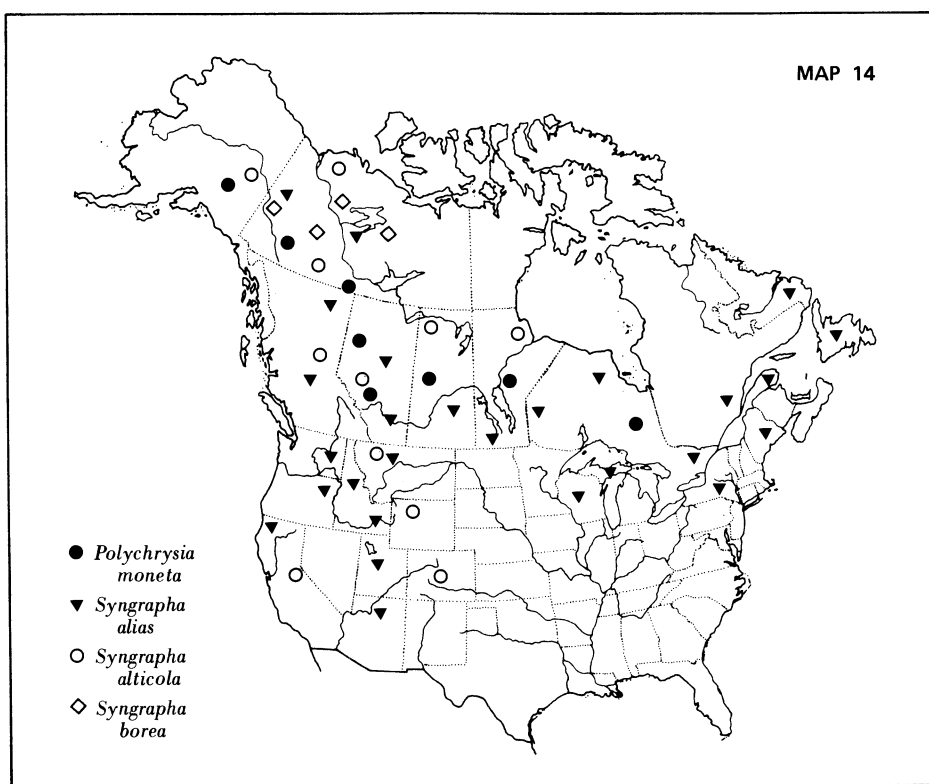
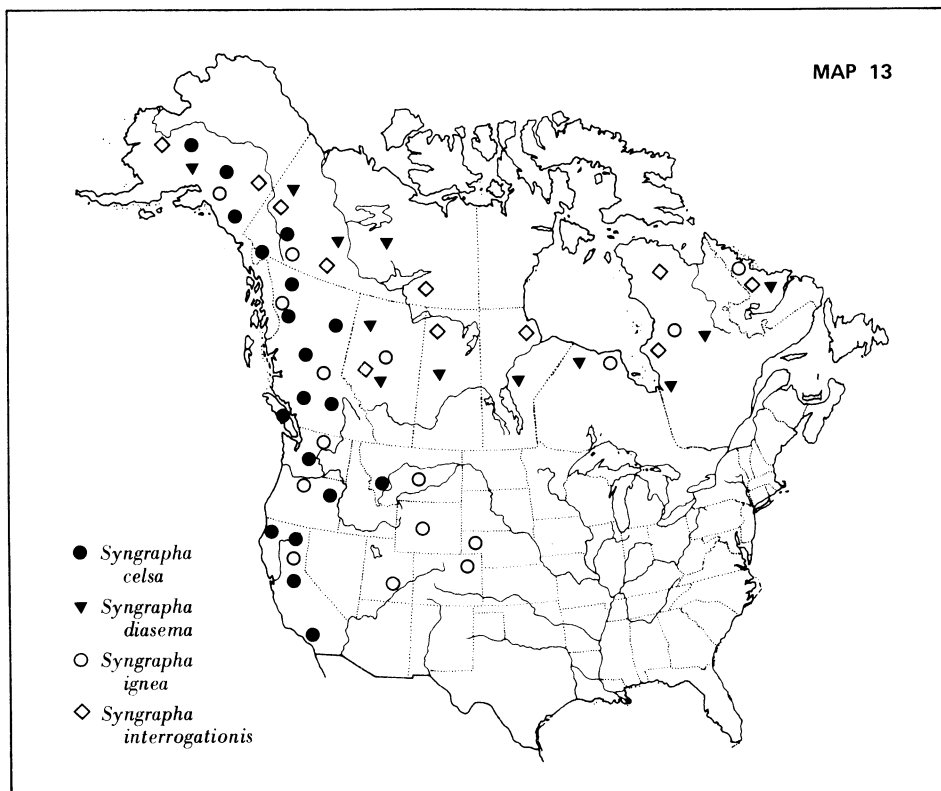


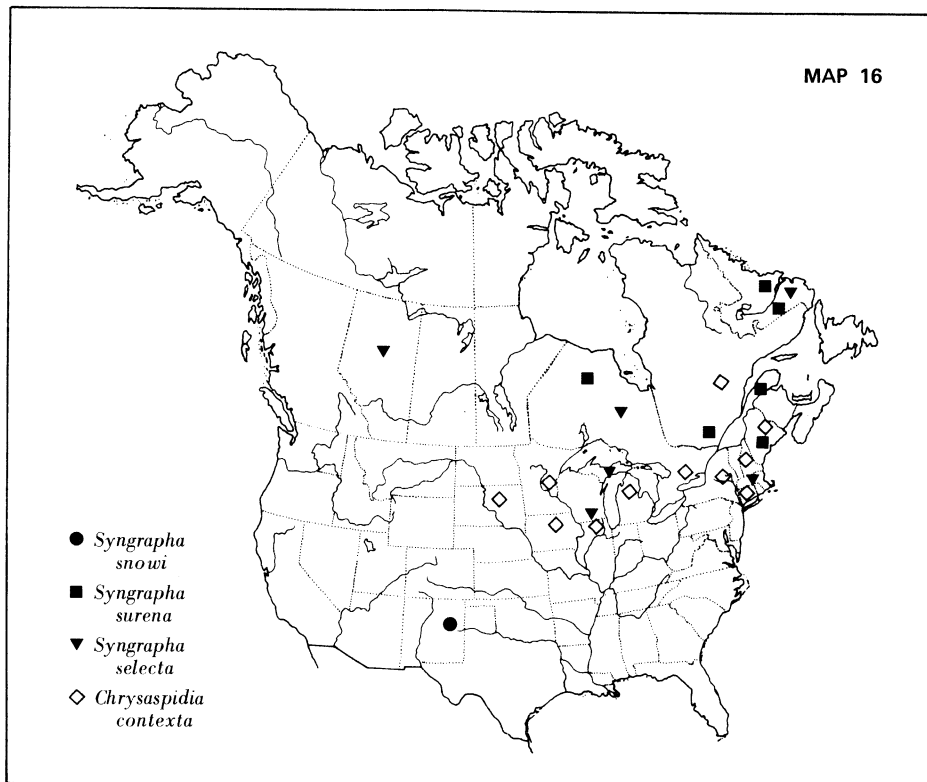
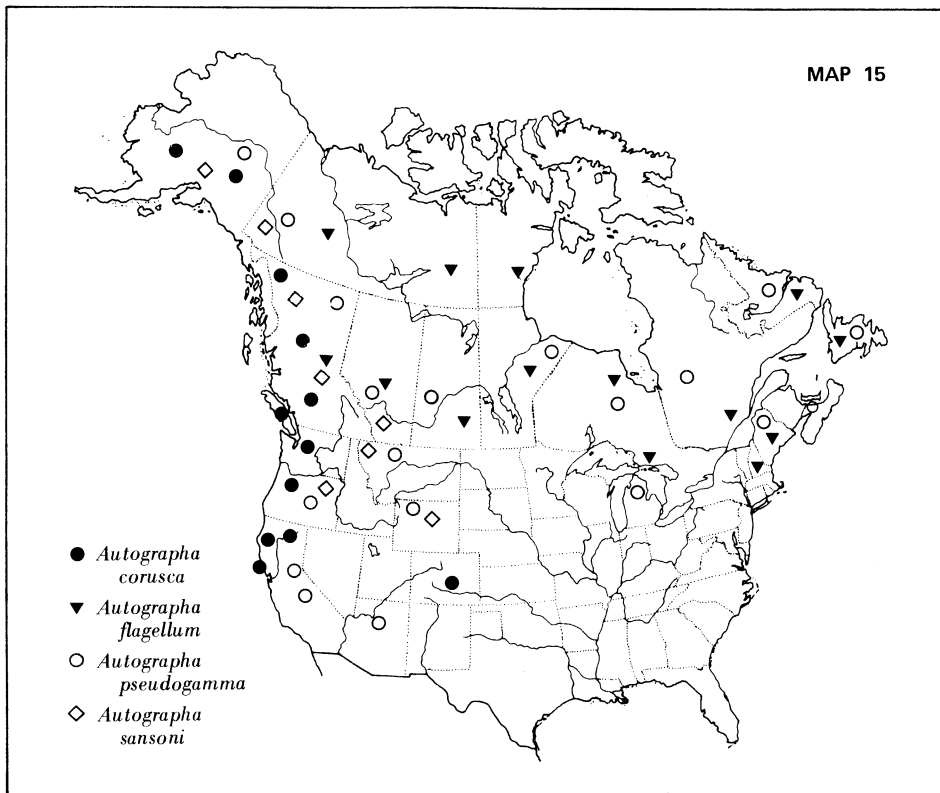


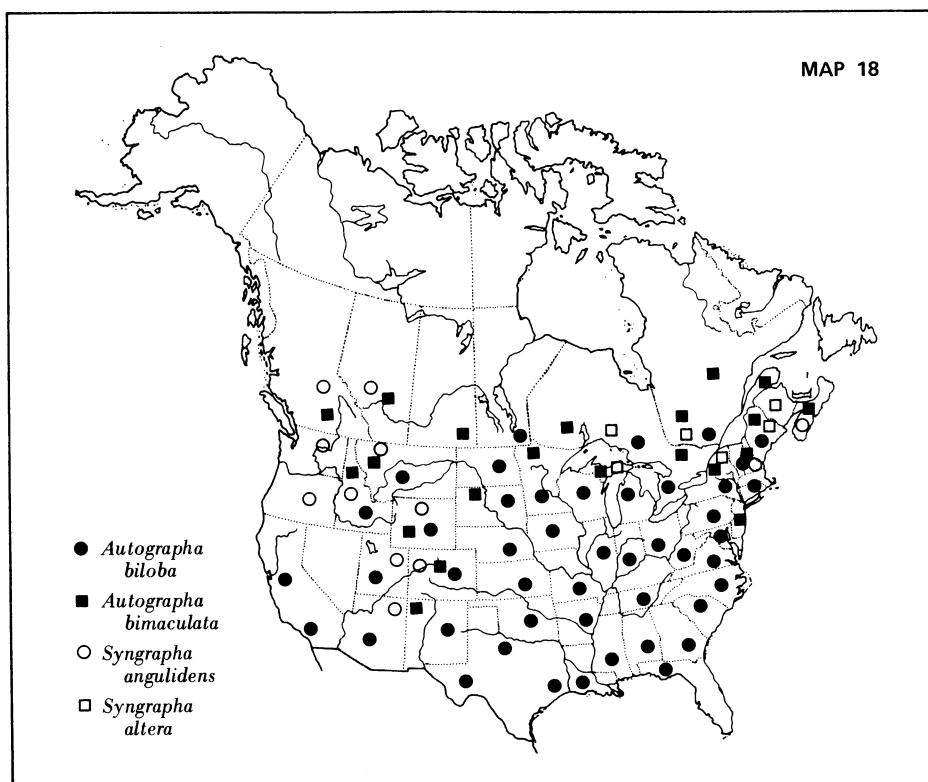
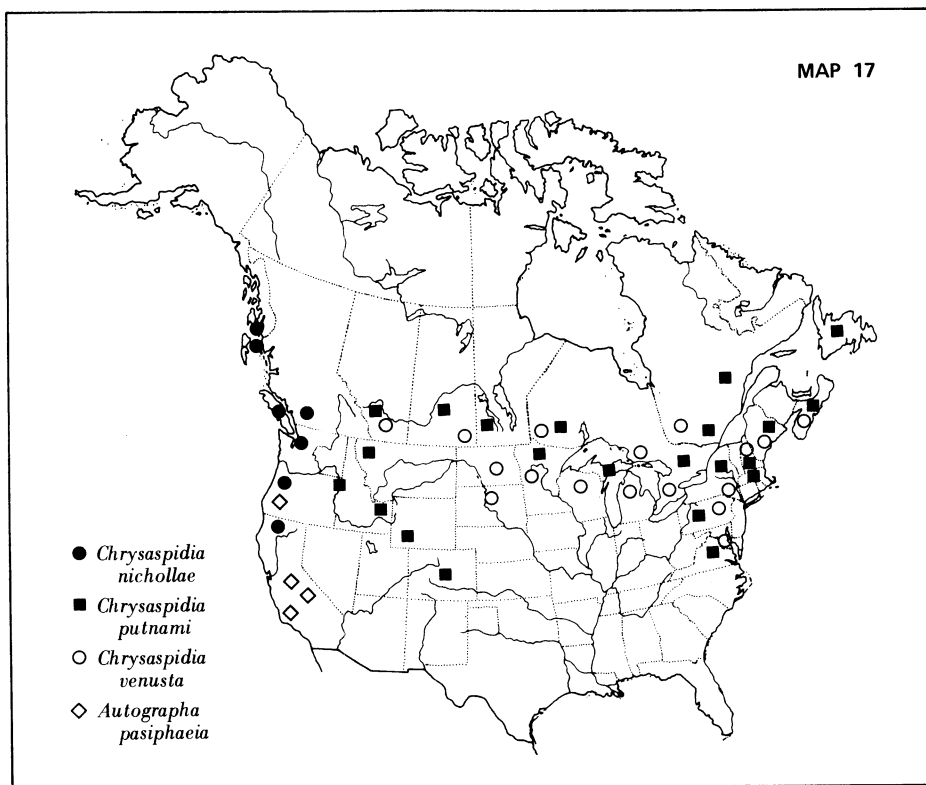


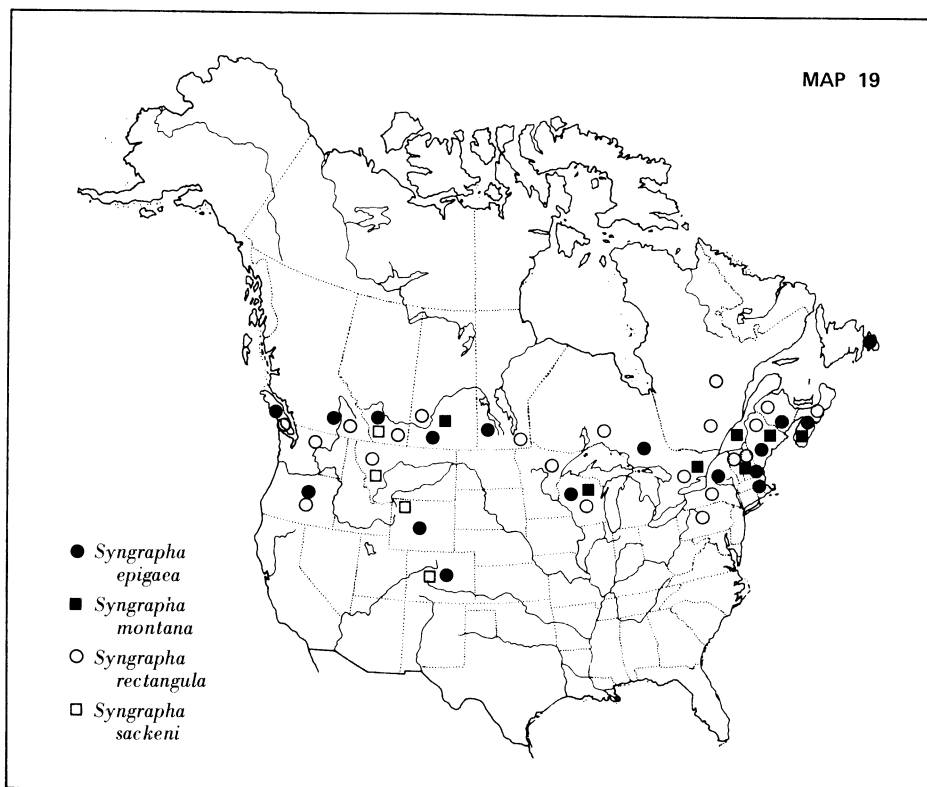


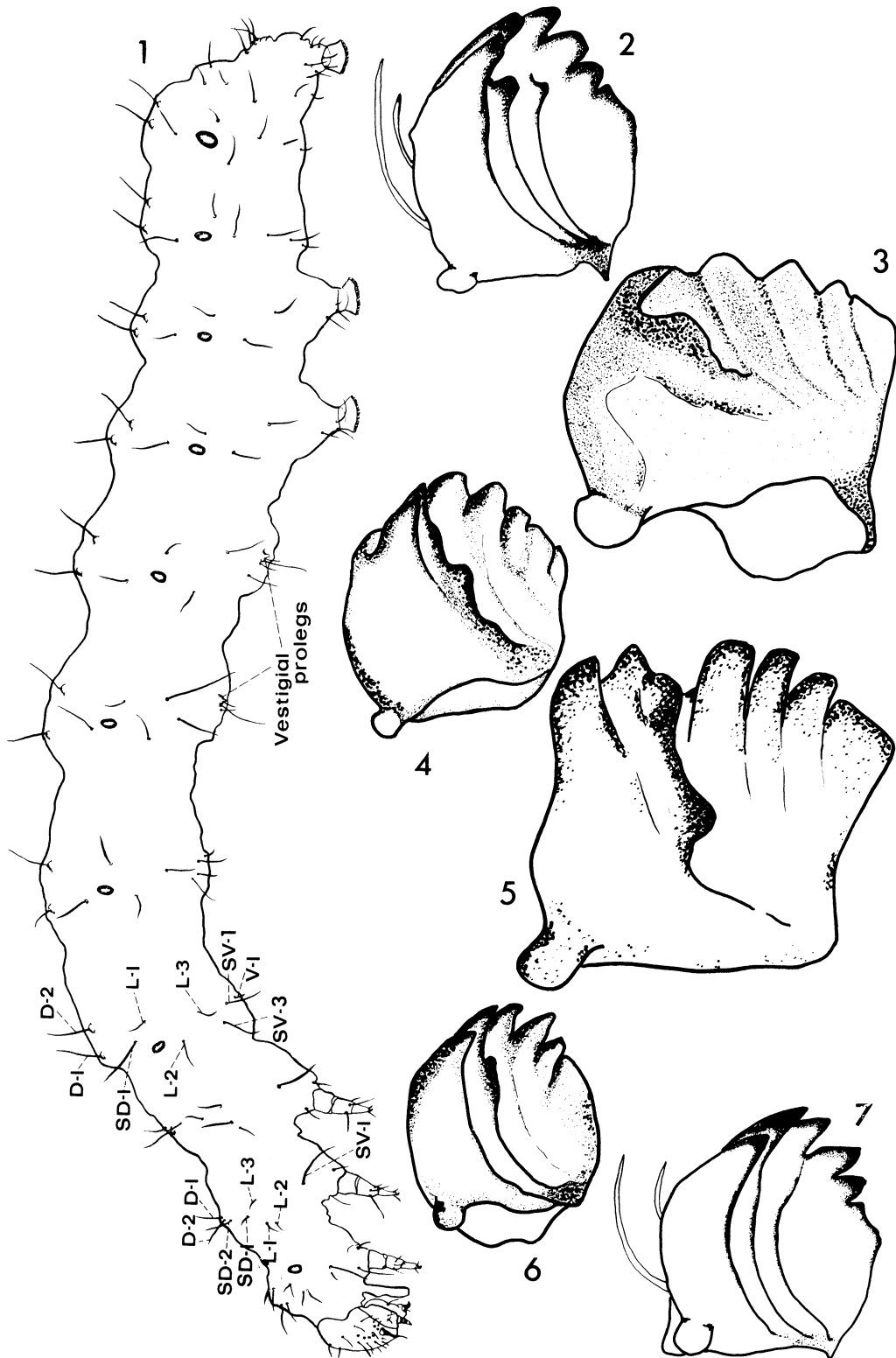




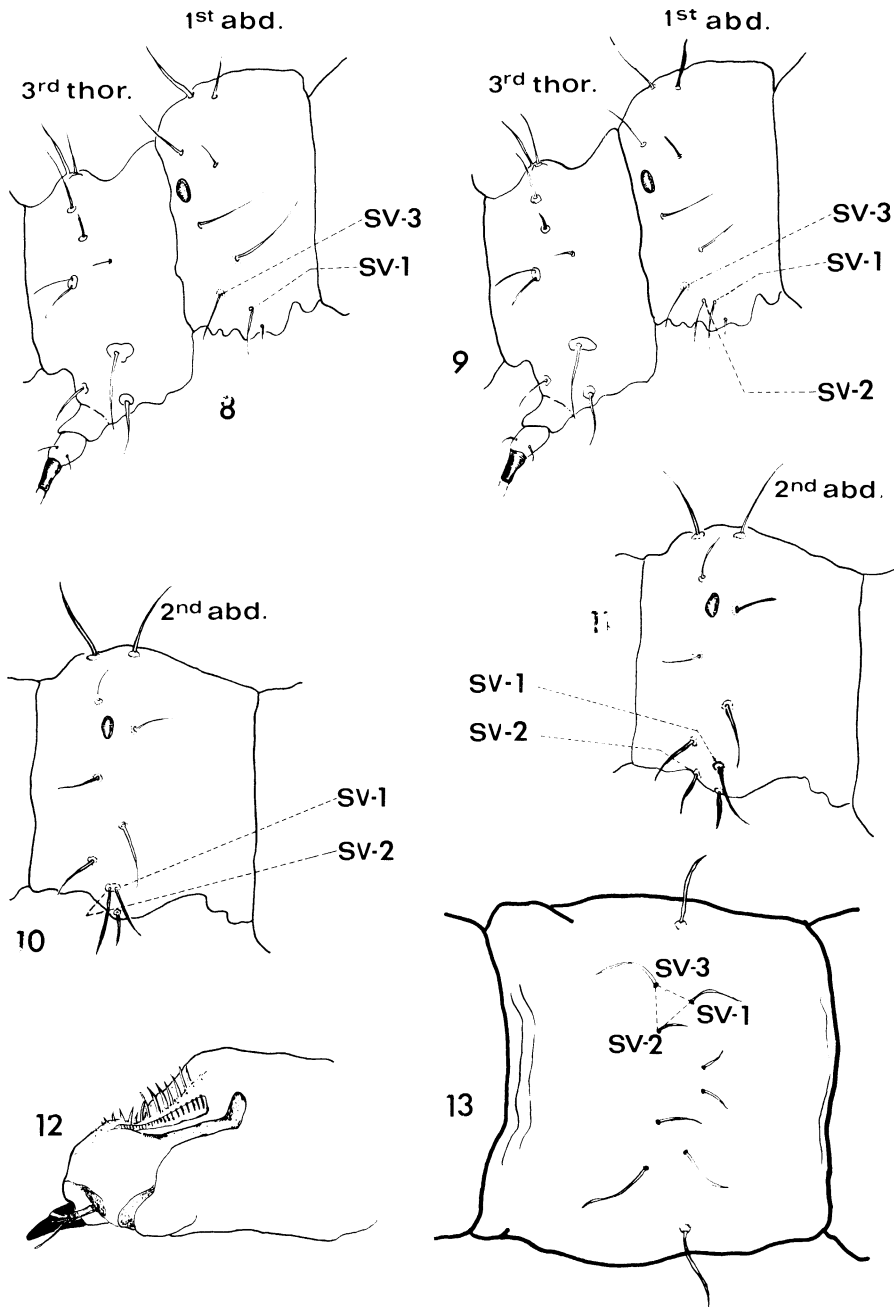




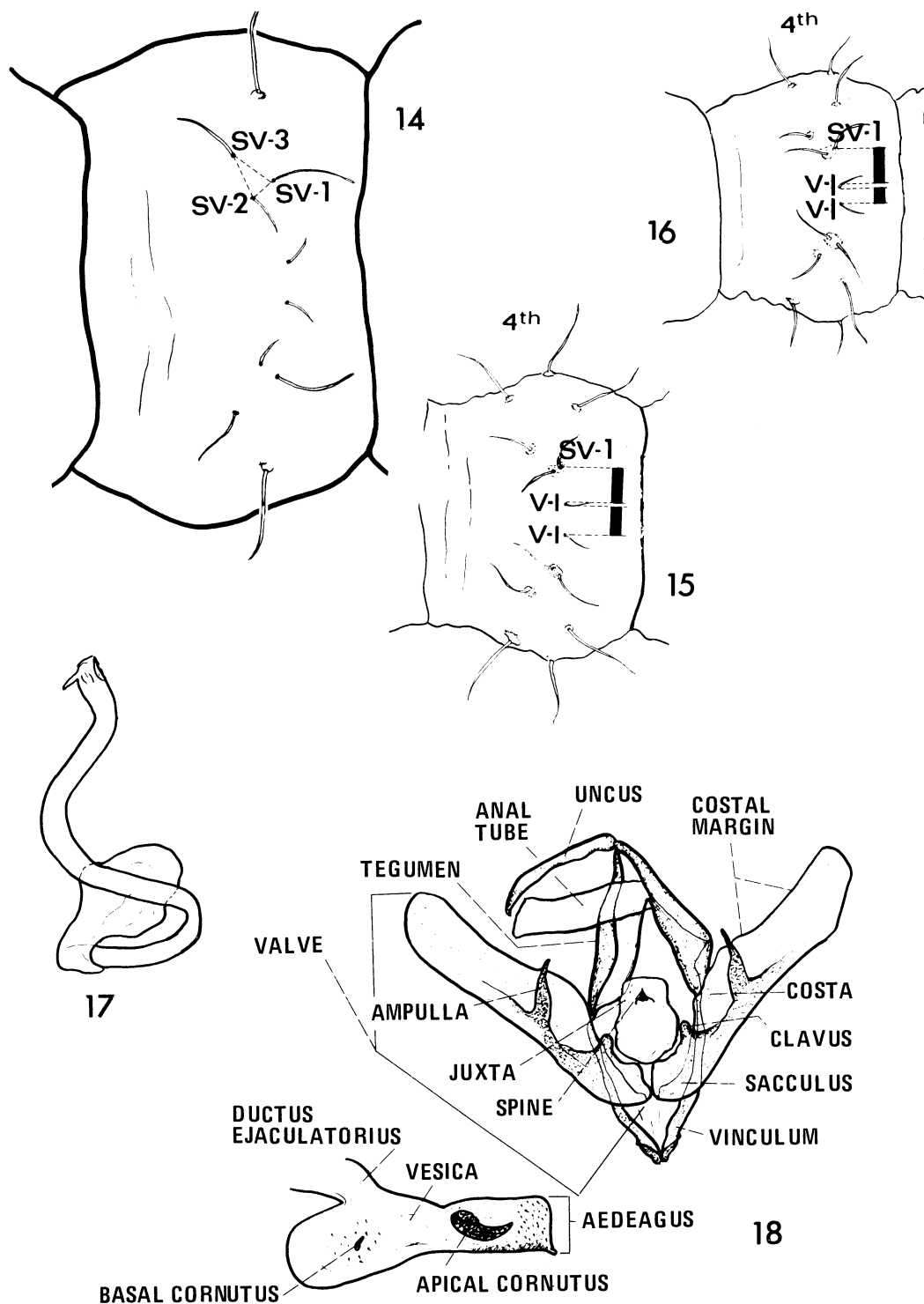




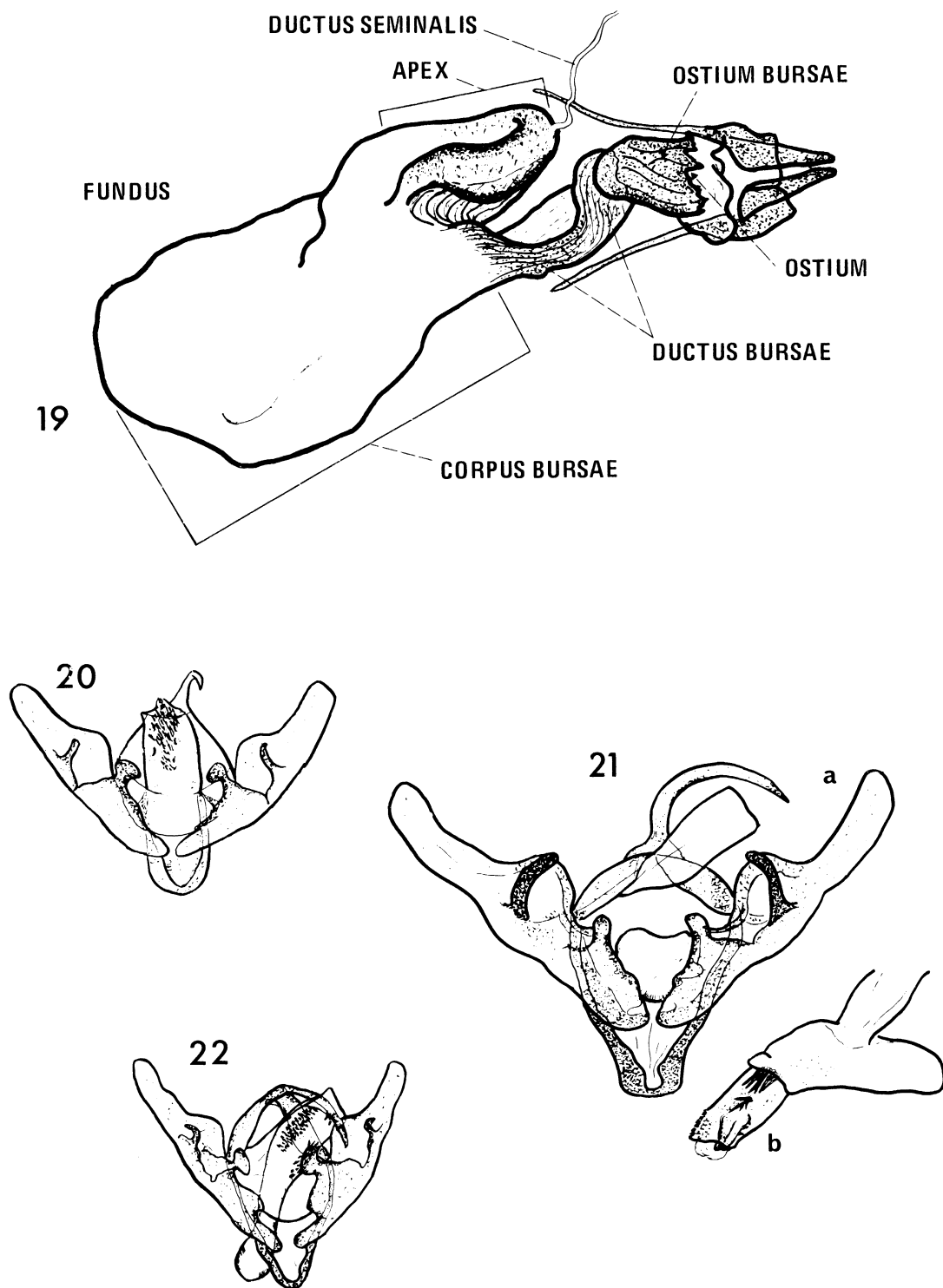
FIGURES 1-7.—Larval chaetotaxy, right mandibles (mesal view): 1, *Trichoptusia ni*; 2, *Pseudoptusia includens*; 3, *Chrysaspidia contexta*; 4, *Abrostola urentis*; 5, *Mouralia tinctoides*; 6, *Polychrysia morigera*; 7, *Trichoptusia ni*.



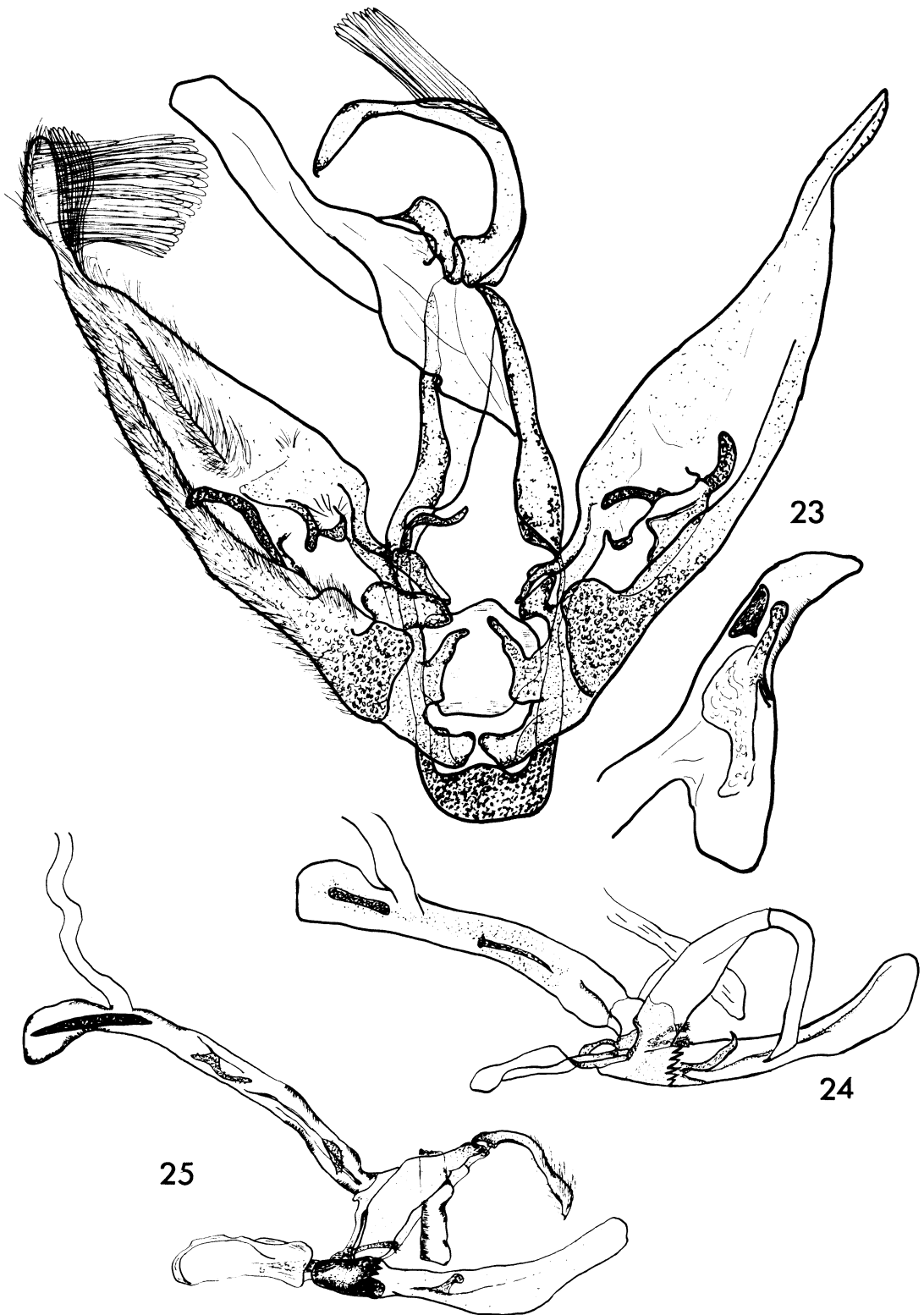
FIGURES 8-13.—Larval chaetotaxy, hypopharyngeal complex (lateral view): 8, SV-2 absent on abdominal segment 1 (lateral view); 9, SV-2 present on abdominal segment 1 (lateral view); 10, pinacula of SV-1 and SV-2 fused on abdominal segment 2 (lateral view); 11, pinacula of SV-1 and SV-2 separated on abdominal segment 2 (lateral view); 12, hypopharyngeal complex of *Trichoplusia oxygramma*; 13, SV setae equidistant apart on abdominal segment 2 (ventral view).



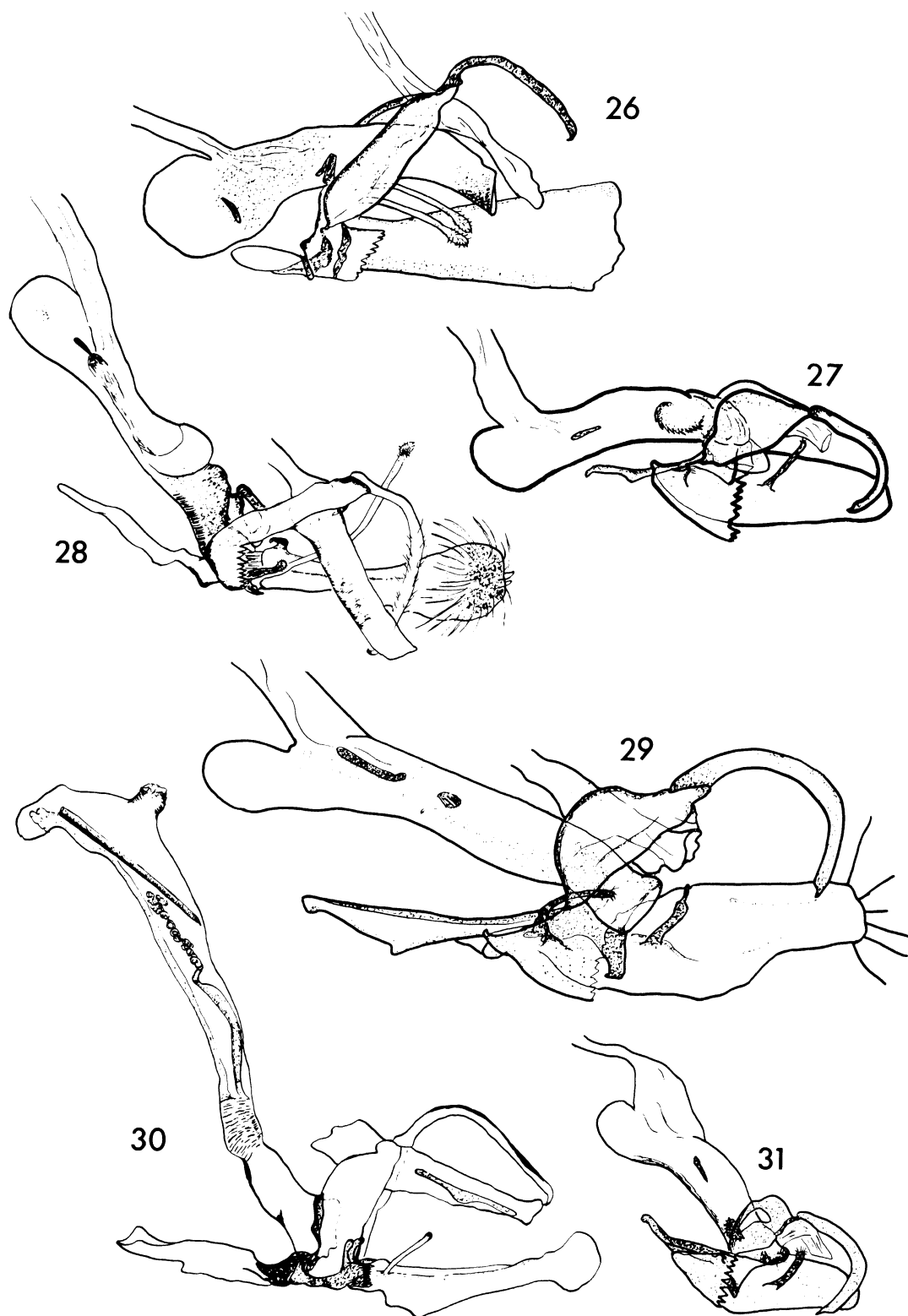
FIGURES 14-18.—Larval chaetotaxy (ventral view), spermatophore, male genitalia: 14, SV-1 and SV-2 closer to each other than to SV-3 on abdominal segment 2; 15-16, relative distances between SV-1 and V-1 on abdominal segment 4; 17, *Syngrapha alticola*; 18, *S. microgamma* (ventral view), aedeagus (lateral view).



FIGURES 19-22.—Genitalia (ventral view): 19, *Syngrapha ignea* (female); 20, *Abrostola parvula* (male); 21a,b, *A. urentis* (male); 22, *A. microvalis* (male).



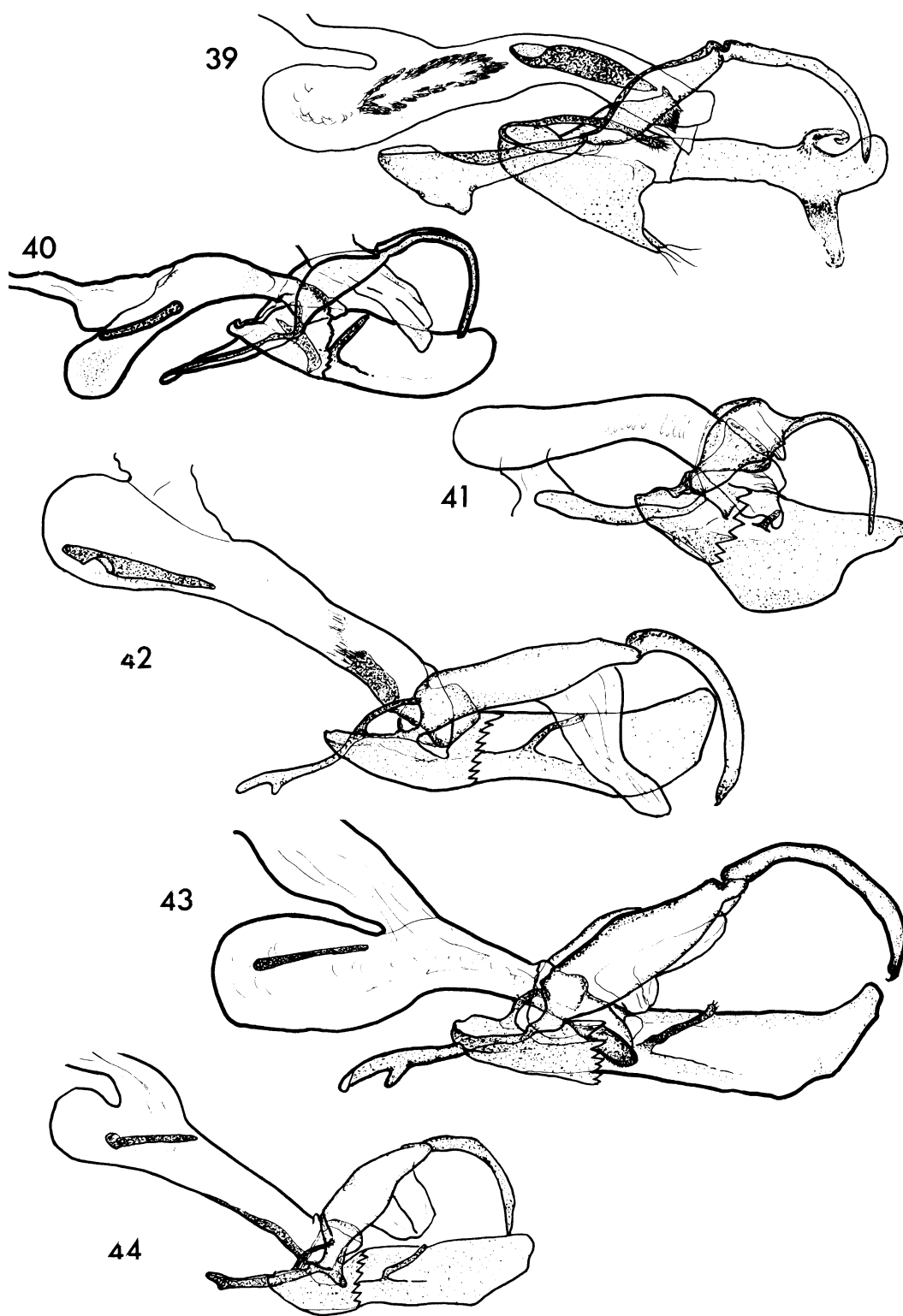
FIGURES 23-25.—Male genitalia: 23, *Mournalia tinctoides* (ventral view); 24, *Argyrogramma basigera* (lateral view, left valve removed); 25, *A. verruca* (lateral view, left valve removed).



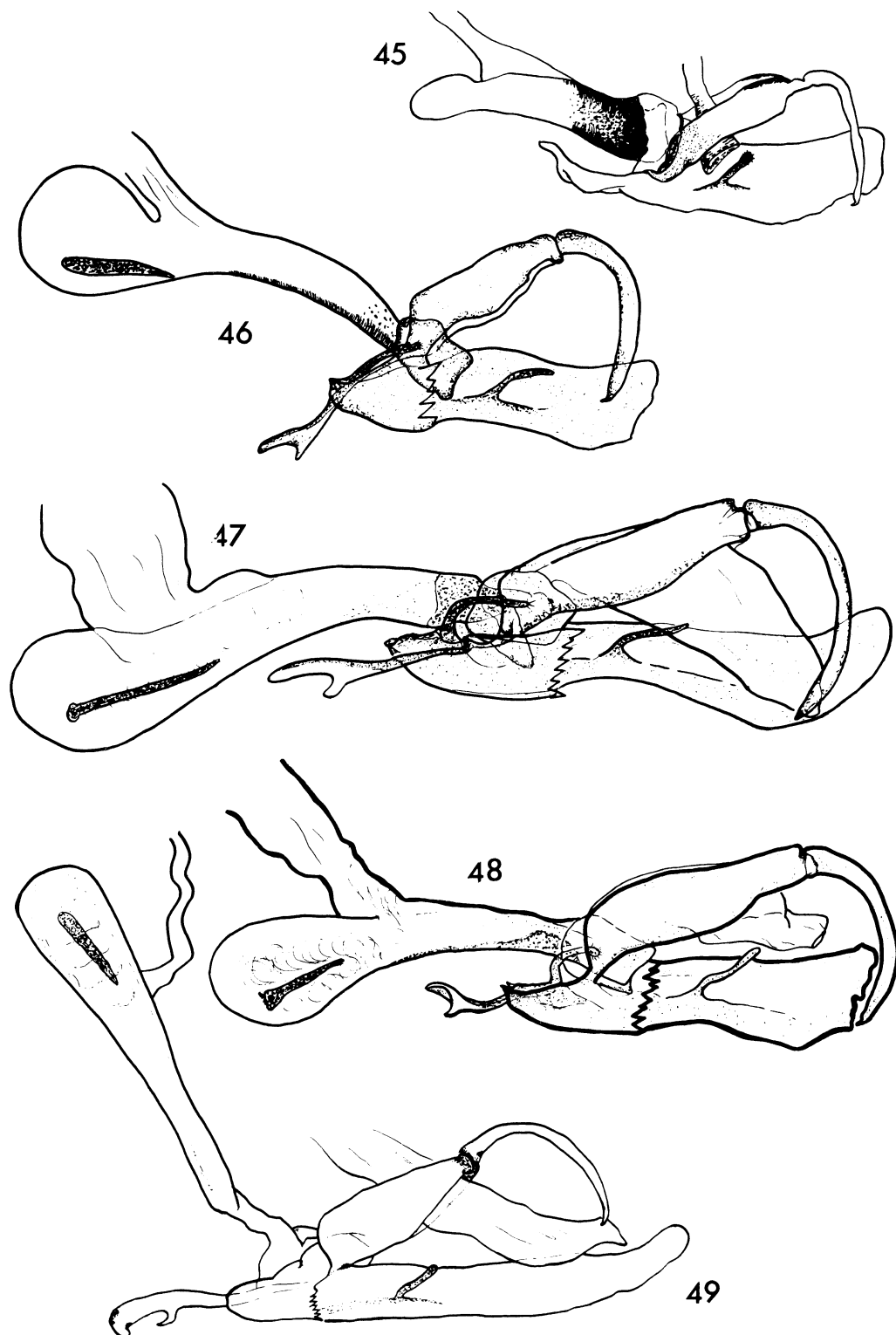
FIGURES 26-31.—Male genitalia (lateral view, left valve removed): 26, *Rachiplusia ou*; 27, *Pseudeva purpurigera*; 28, *Pseudoplusia includens*; 29, *Plusia balluca*; 30, *Trichoplusia oxygramma*; 31, *Pseudeva palligera*.



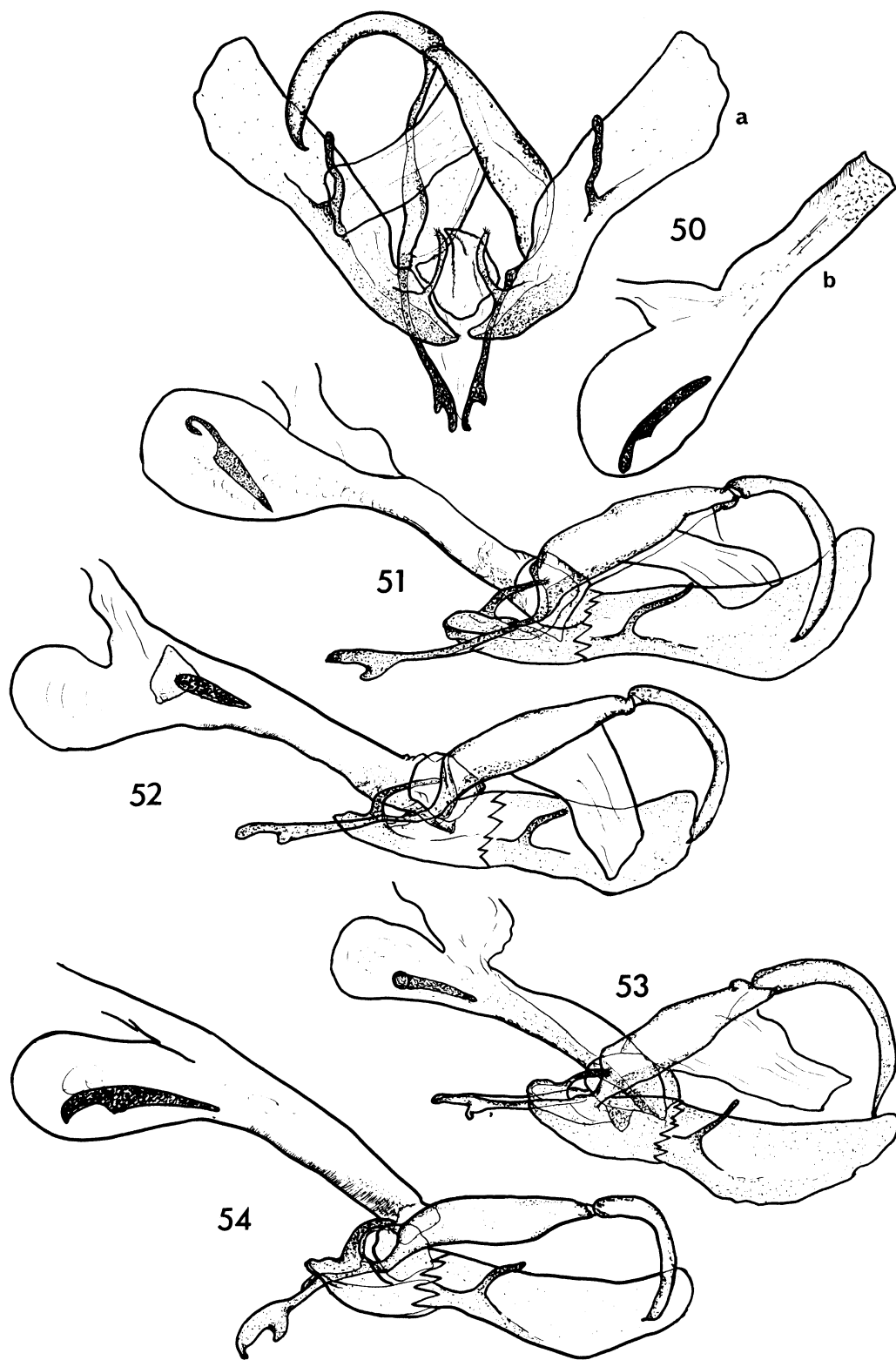
FIGURES 32-38.—Male genitalia (32-35, 38, lateral view, left valve removed; 36-37, ventral view): 32, *Adeva albavitta*; 33, *Allagrapha aeroides*; 34, *Trichoplusia ni*; 35, *Allagrapha aerea*; 36a,b, *Polychrysis moneta*; 37a,b, *P. morigera*; 38, *Autoplusia egena*.



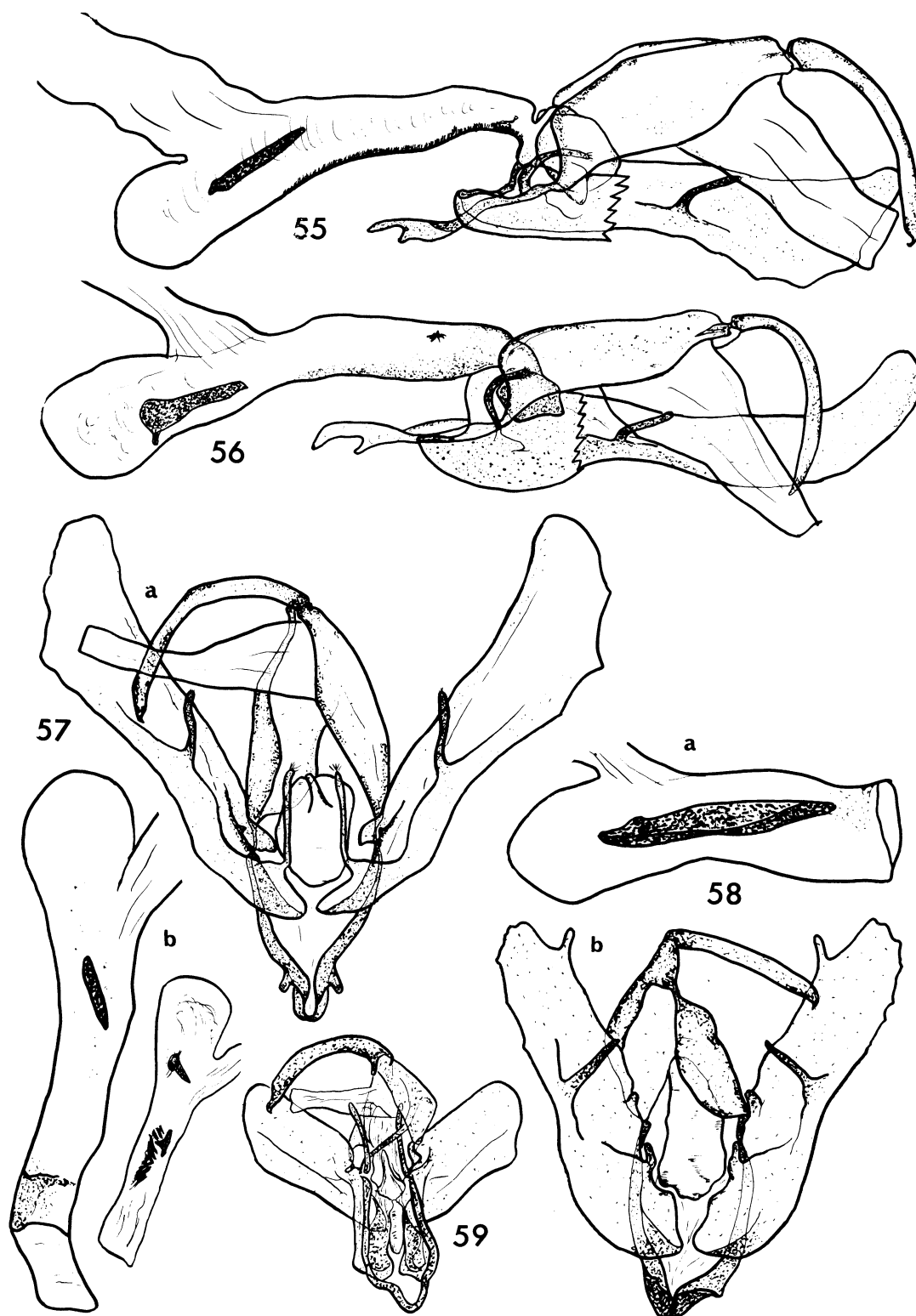
FIGURES 39-44.—Male genitalia (lateral view, left valve removed); 39, *Autoplusia olivacea*; 40, *Chrysanympha formosa*; 41, *Eosphropteryx thyatyroides*; 42, *Autographa mappa*; 43, *A. bimaculata*; 44, *A. pasiphaeia*.



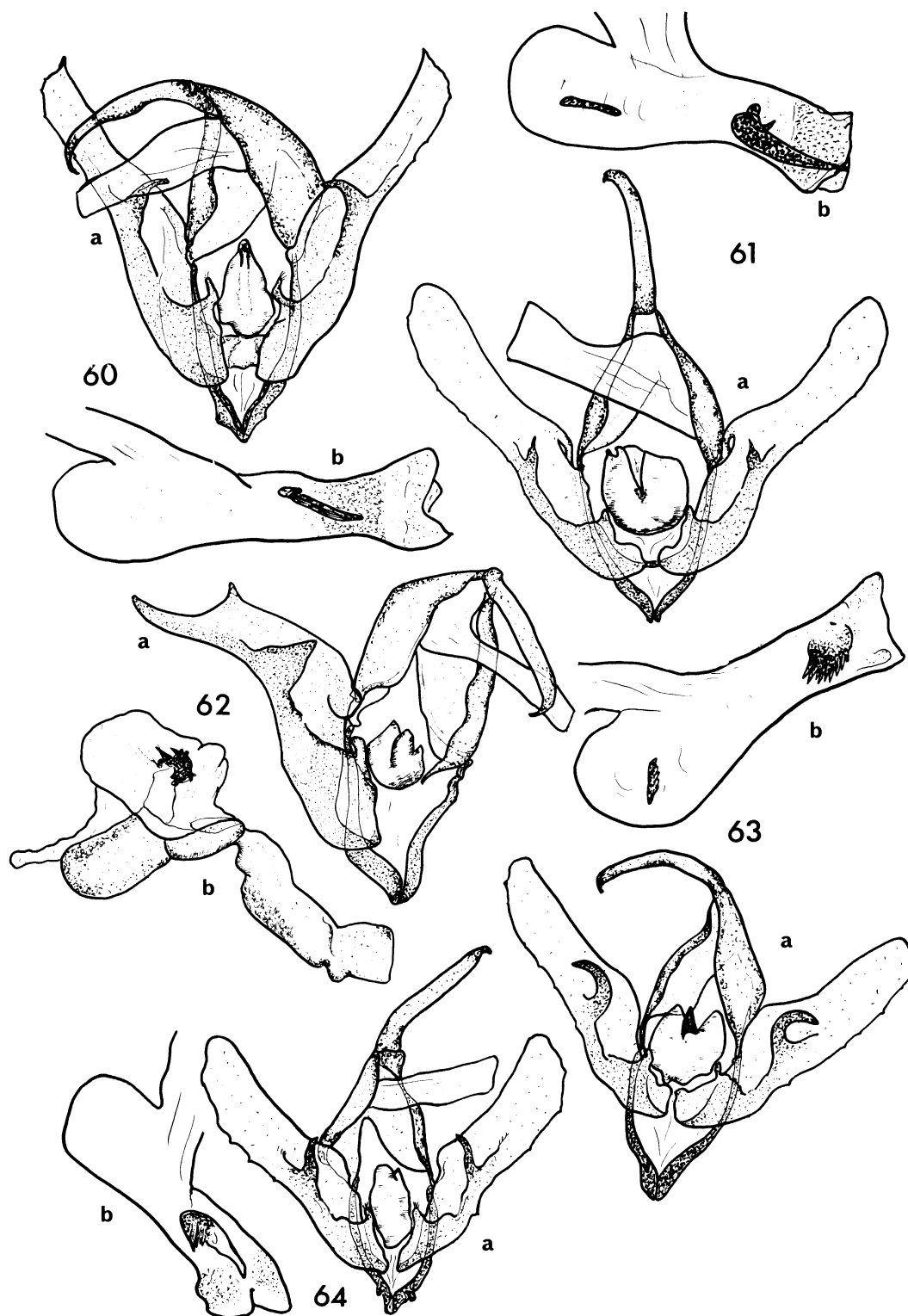
FIGURES 45-49.—Male genitalia (lateral view, left valve removed): 45, *Autographa biloba*; 46, *A. speciosa*; 47, *A. flagellum*; 48, *A. corusca*; 49, *A. precatationis*.



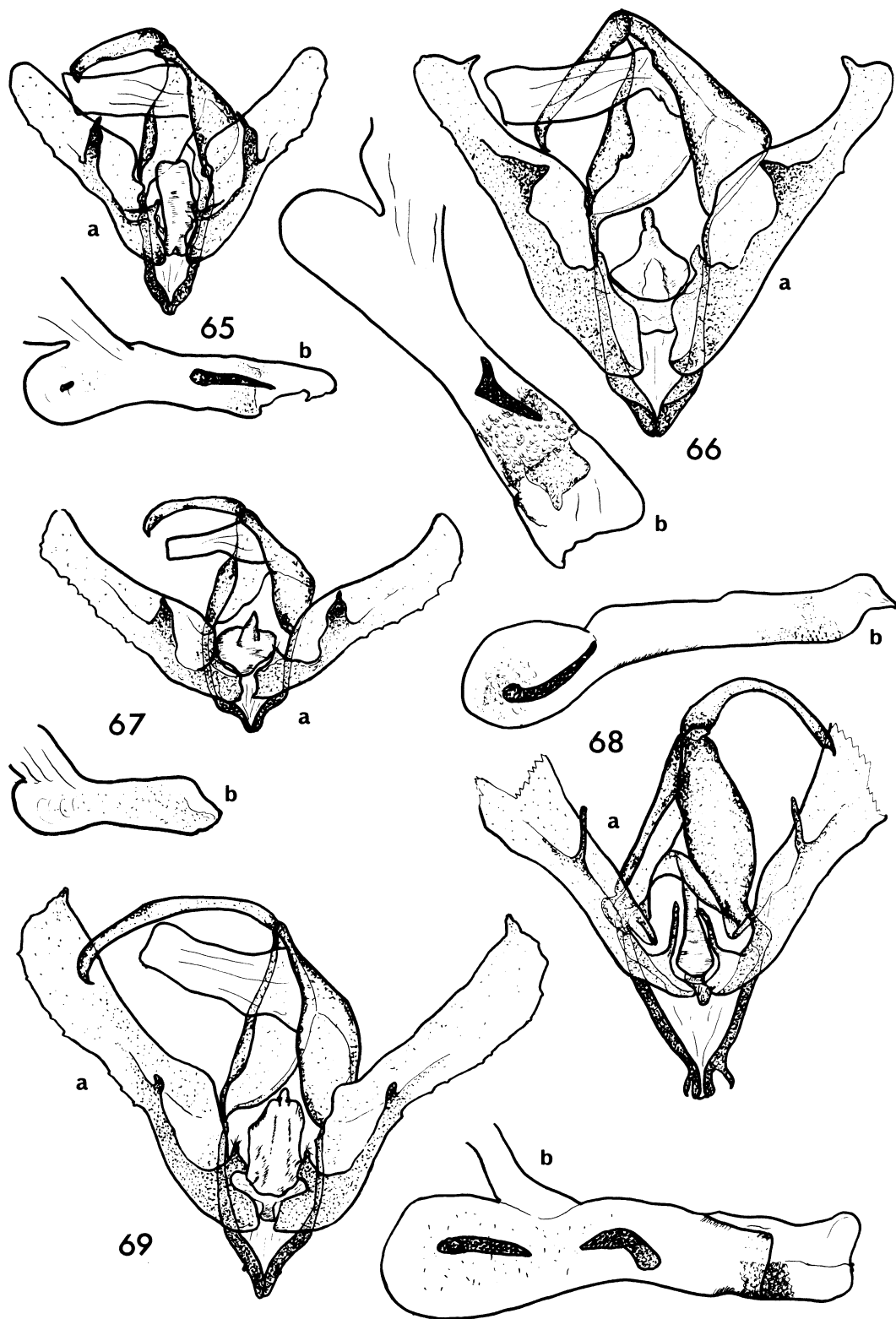
FIGURES 50-54.—Male genitalia (50, ventral view; 51-54, lateral view, left valve removed): 50a,b, *Autographa labrosa*; 51, *A. metallica*; 52, *A. v-alba*; 53, *A. californica*; 54, *A. sansoni*.



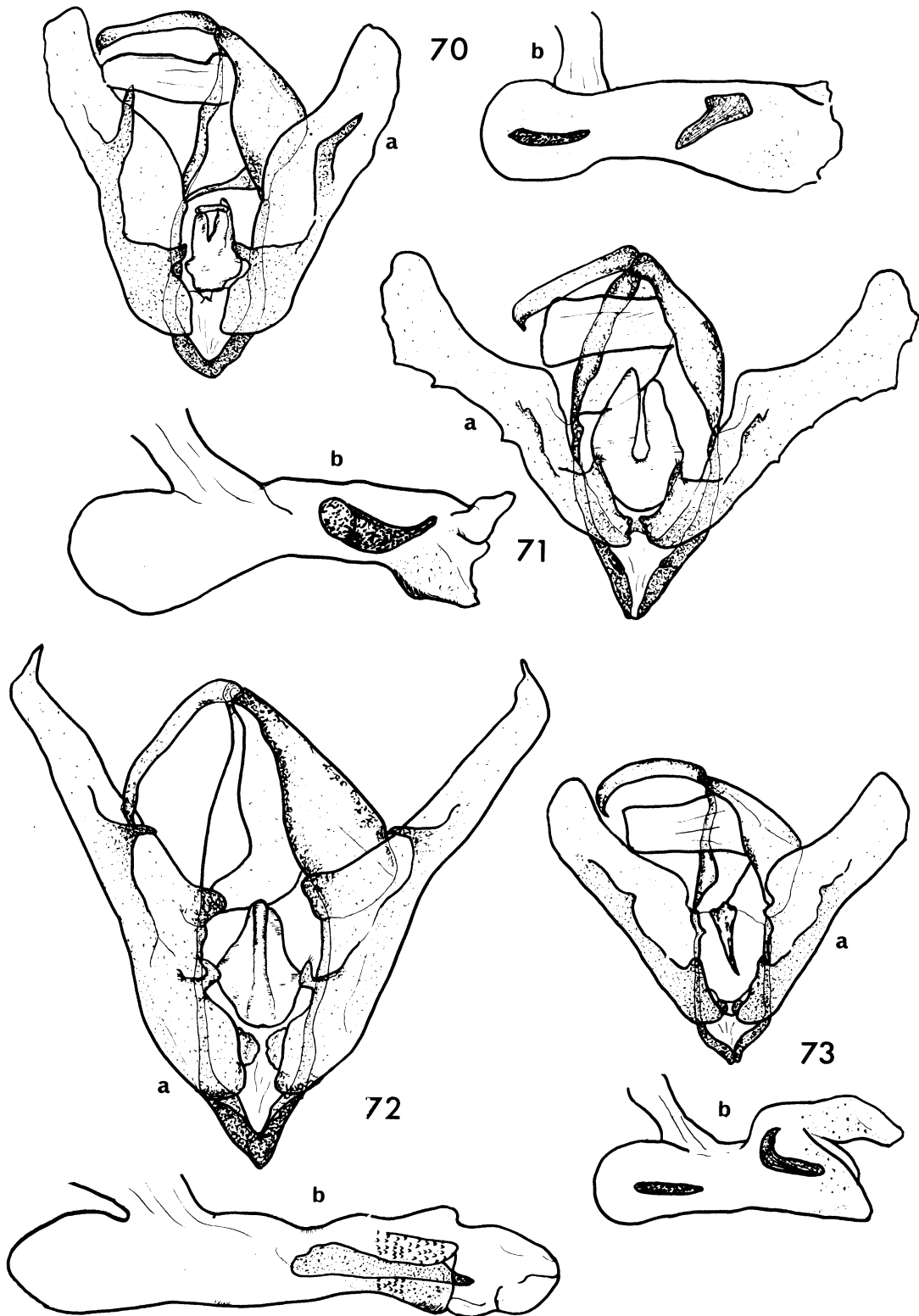
FIGURES 55-59.—Male genitalia (55-56, lateral view, left valve removed; 57-59, ventral view): 55, *Autographa ampla*; 56, *A. rubida*; 57a,b, *A. pseudogamma*; 58a,b, *Syngrapha epigaea*; 59, *Autoplusia illustrata*.



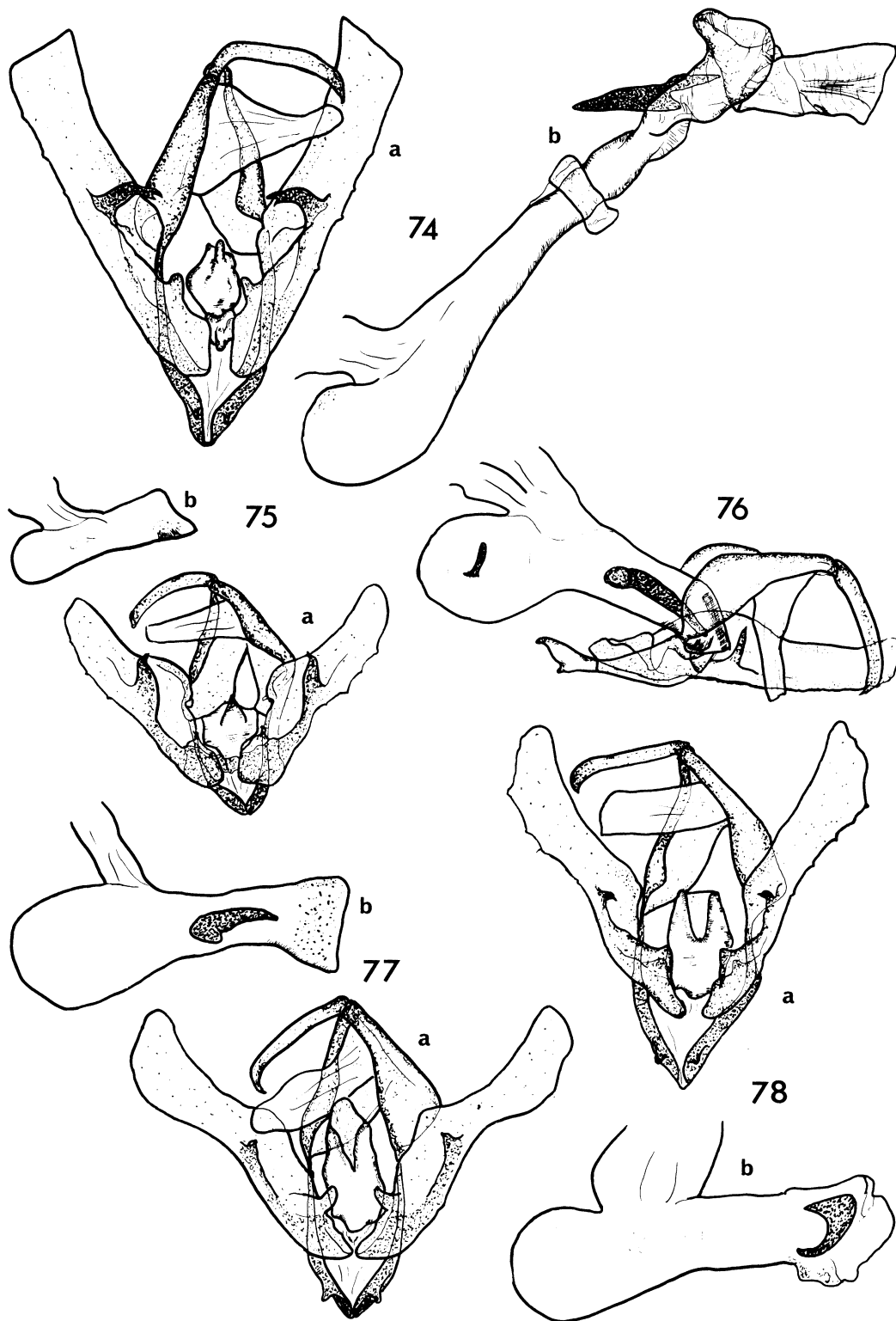
FIGURES 60-64.—Male genitalia (ventral view, aedeagus lateral view): 60a,b, *Syngrapha altera*; 61a,b, *S. celsa*; 62a,b, *S. ignea*; 63a,b, *S. ignea*; 64a,b, *S. abstrusa*.



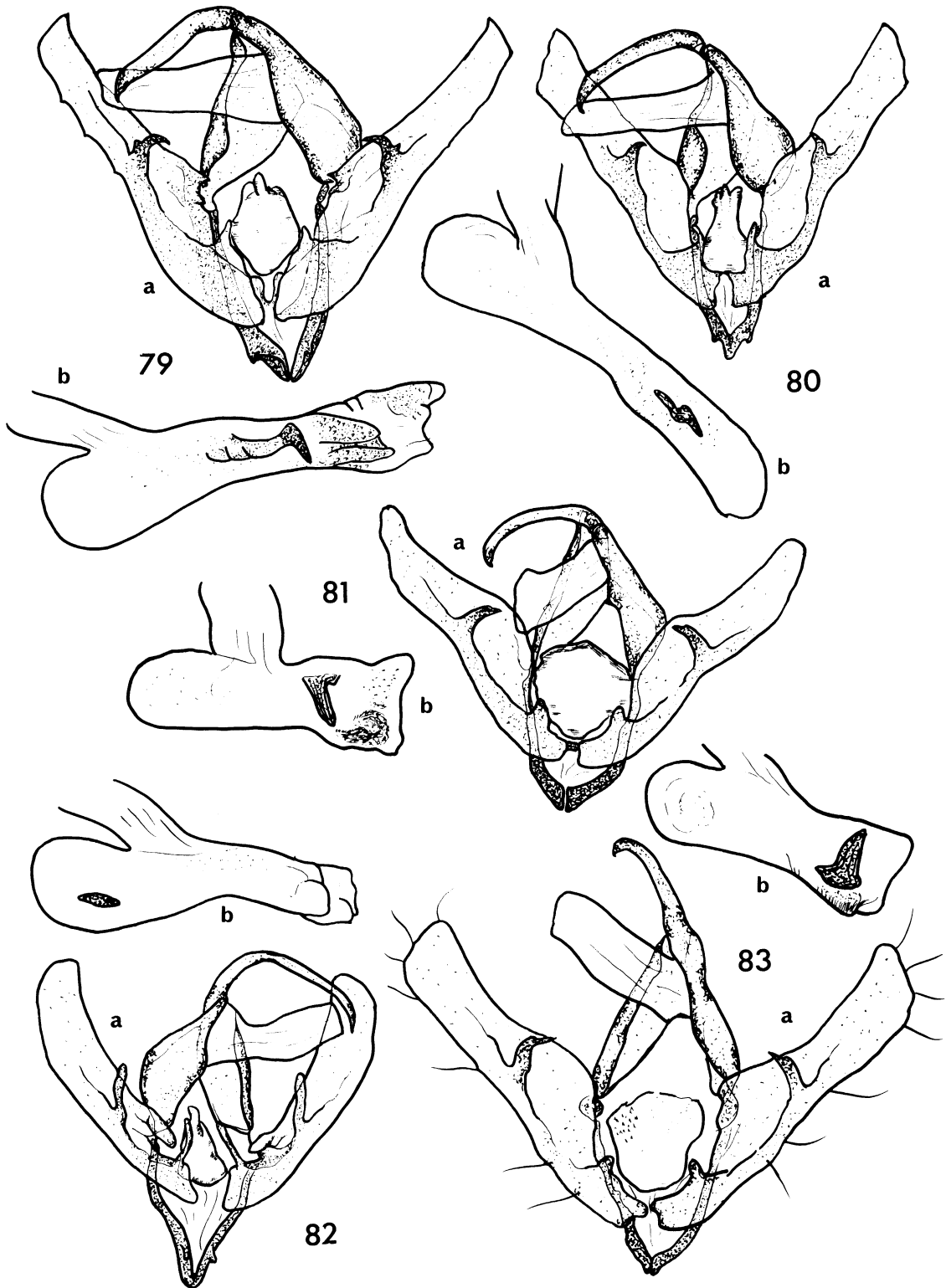
FIGURES 65-69.—Male genitalia (ventral view, aedeagus lateral view): 65a,b, *Syngrapha montana*; 66a,b, *S. octoscripta*; 67a,b, *S. parilis*; 68a,b, *S. ottolenguii*; 69a,b, *S. viridisigma*.



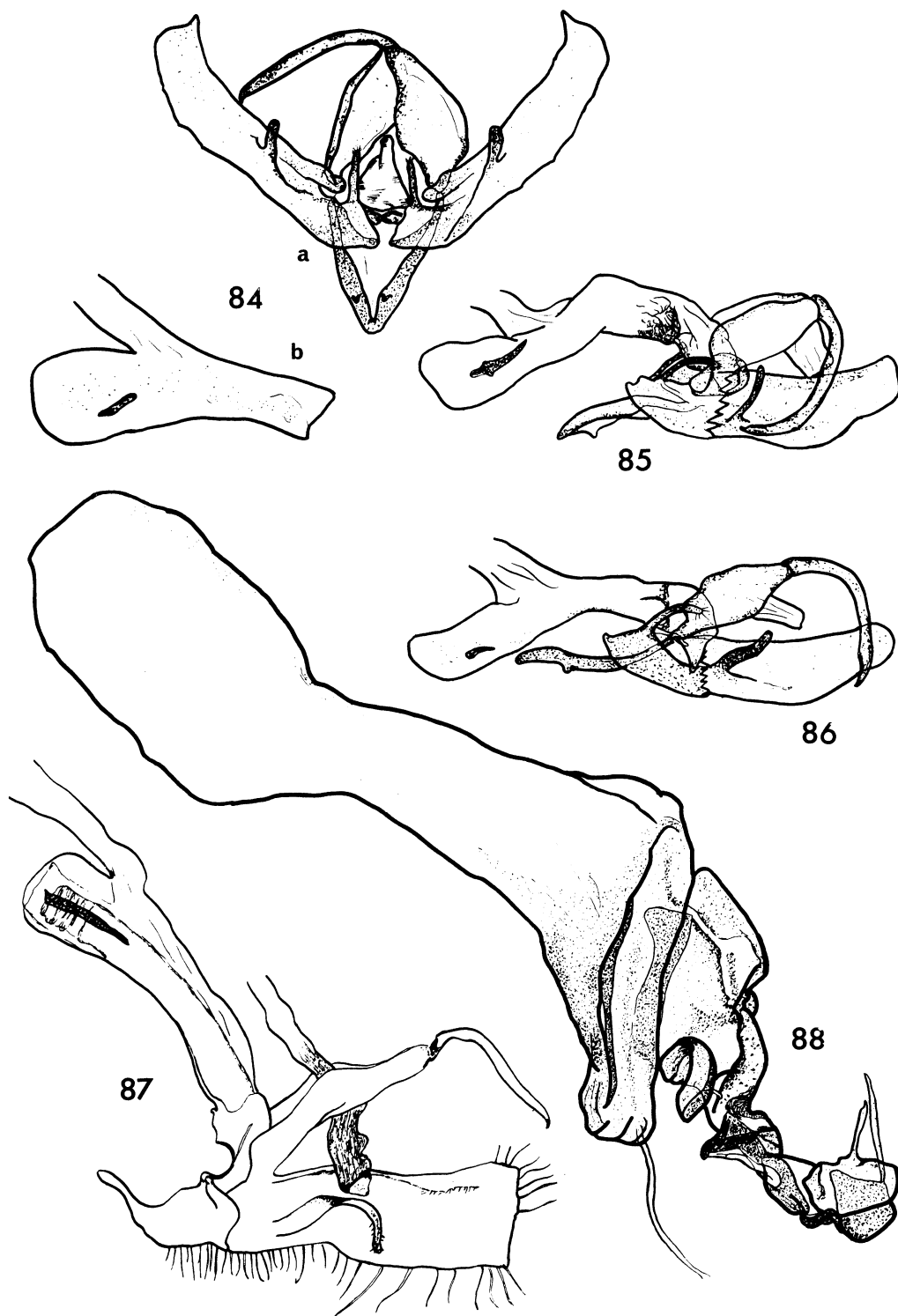
FIGURES 70-73.—Male genitalia (ventral view, aedeagus lateral view): 70a,b, *Syngrapha orophila*; 71a,b, *S. cryptica*; 72a,b, *S. selecta*; 73a,b, *A. sackeni*.



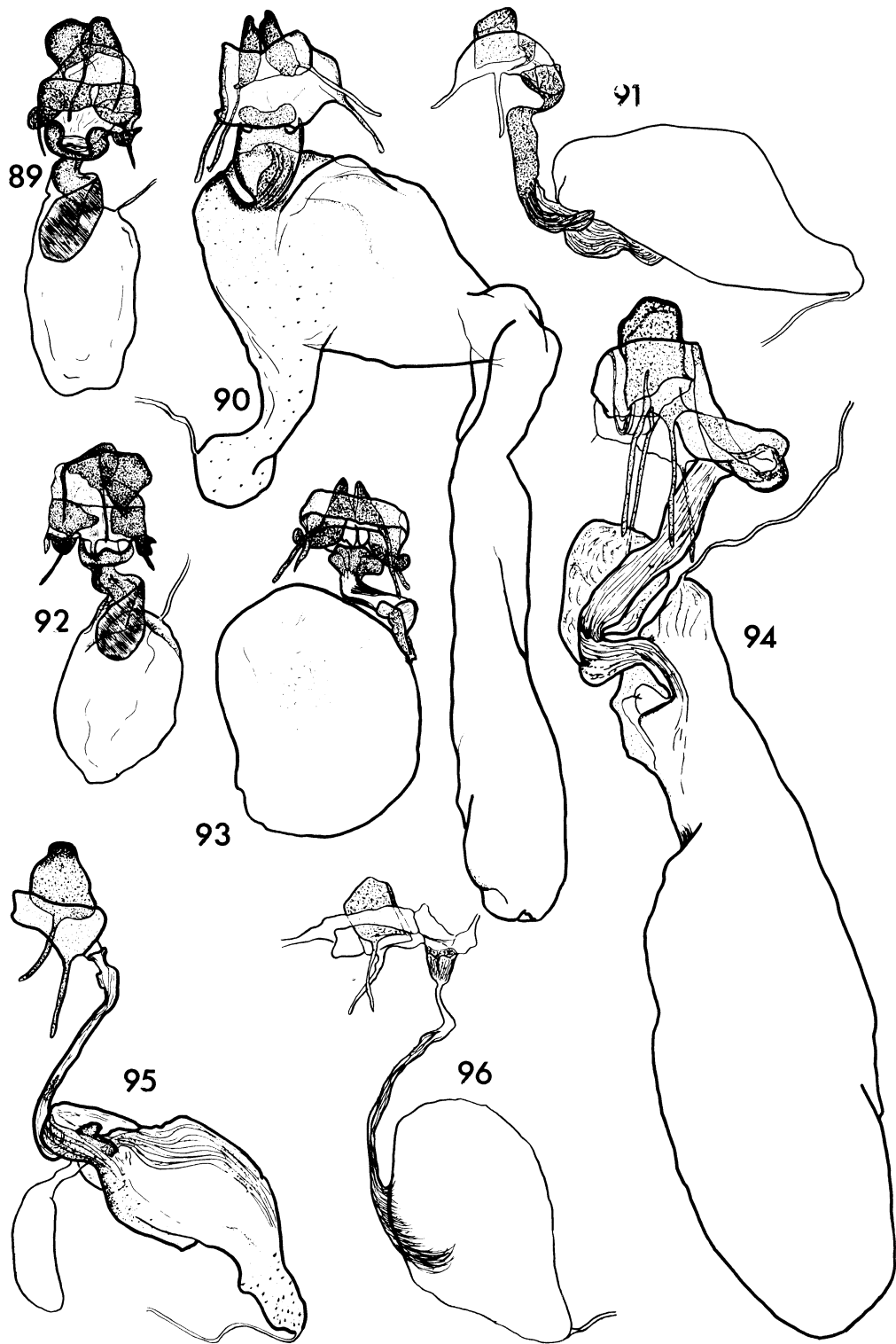
FIGURES 74-78.—Male genitalia (74, 75, 77, 78, ventral view, aedeagus lateral view; 76, lateral view, left valve removed); 74a,b, *Syngrapha surena*; 76, *S. angulidens*; 75a, b, *S. alticola*; 77a,b, *S. rectangulara*; 78a,b, *S. alias*.



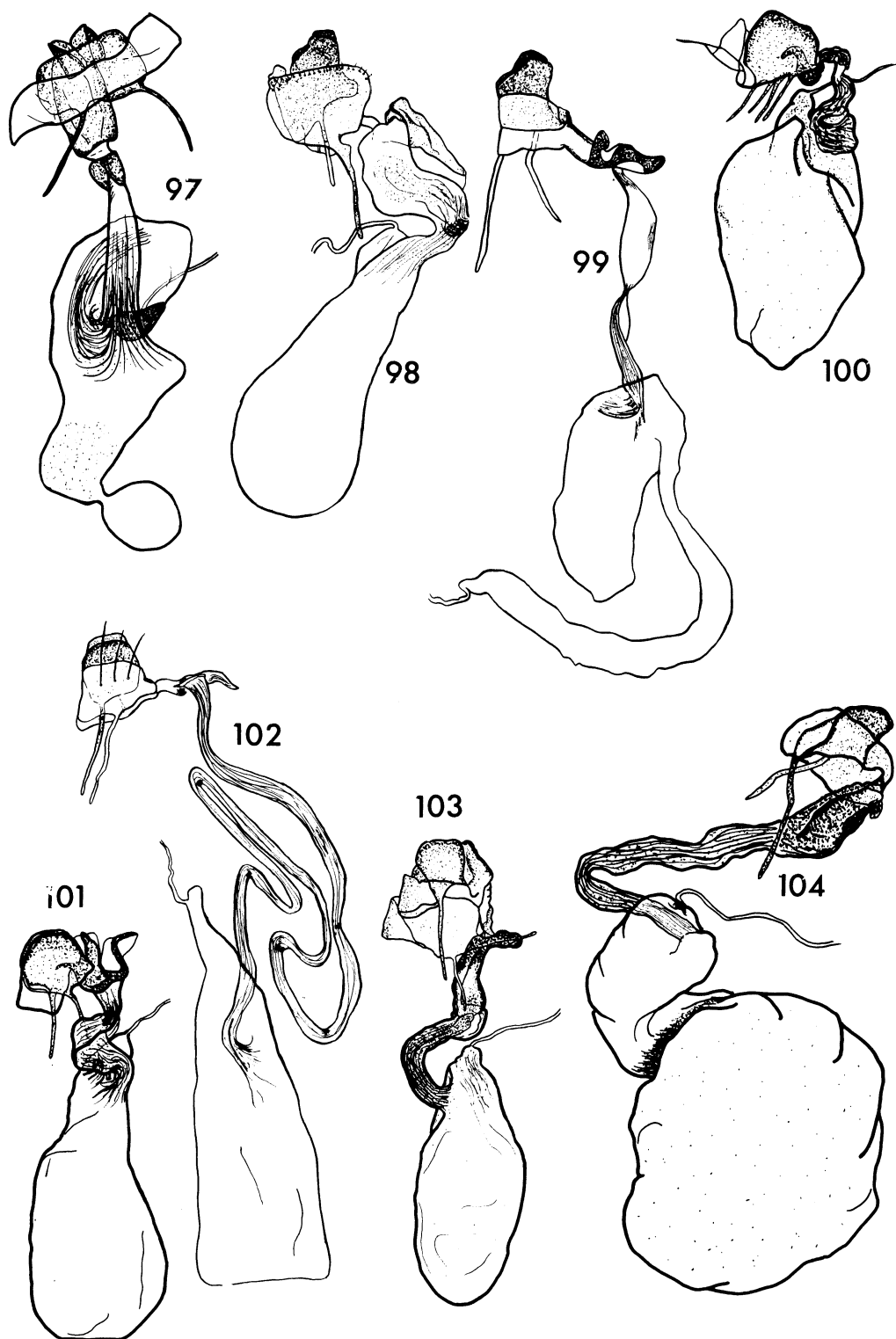
FIGURES 79–83.—Male genitalia (ventral view, aedeagus lateral view): 79a,b, *Syngrapha interrogationis*; 80a,b, *S. u-aureum*; 81a,b, *S. lula*; 82a,b, *Chrysaspidia putnami*; 83a,b, *S. diasema*.



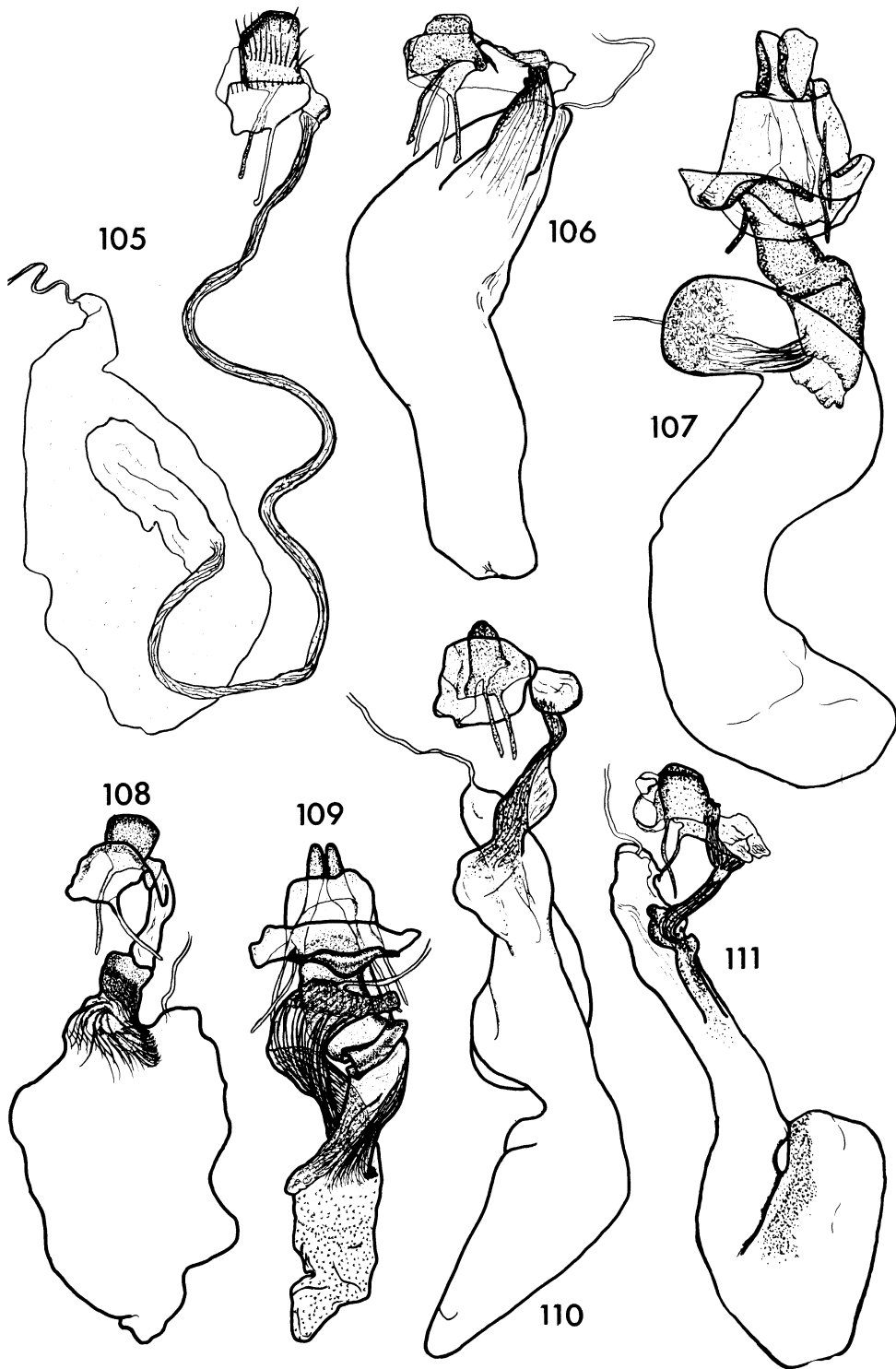
FIGURES 84-88.—Genitalia (84, ventral view, aedeagus lateral view; 85-87, lateral view): 84a,b, *Chrysaspidia contexta* (male); 85, *C. nichollae* (male, left valve removed); 86, *C. venusta* (male, left valve removed); 87, *Syngrapha falcifera* (male, left valve removed); 88, *Abrostola ovalis* (female).



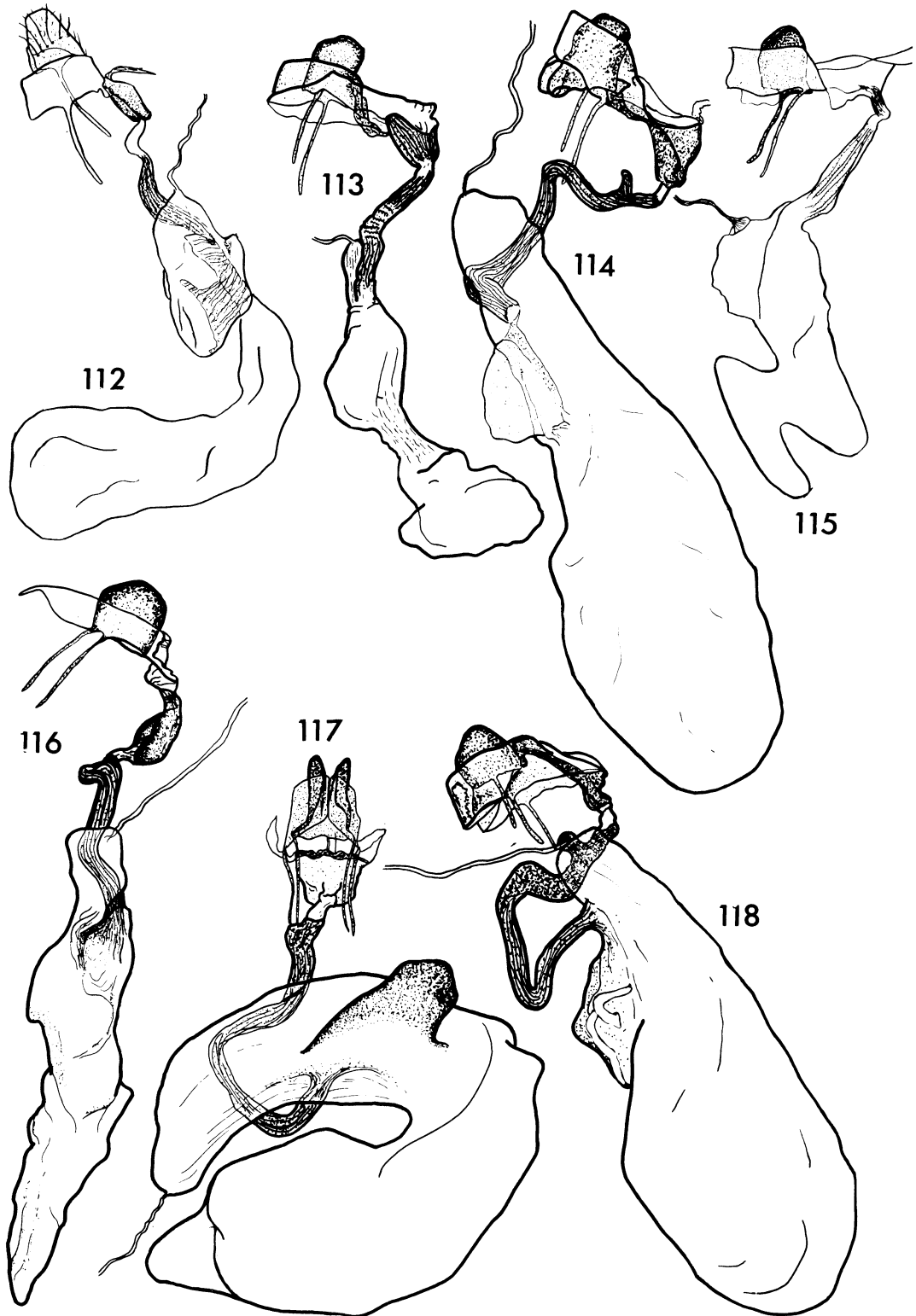
FIGURES 89-96.—Female genitalia: 89, *Abrostola parvula* (dorsal view); 90, *Mouralia tinctoides* (ventral view); 91, *Argyrogramma basigera* (lateral view); 92, *Abrostola microvalis* (dorsal view); 93, *A. urentis* (dorsal view); 94, *Plusia balluca* (lateral view); 95, *Autoplusia illustrata* (lateral view); 96, *Argyrogramma verruca* (lateral view).



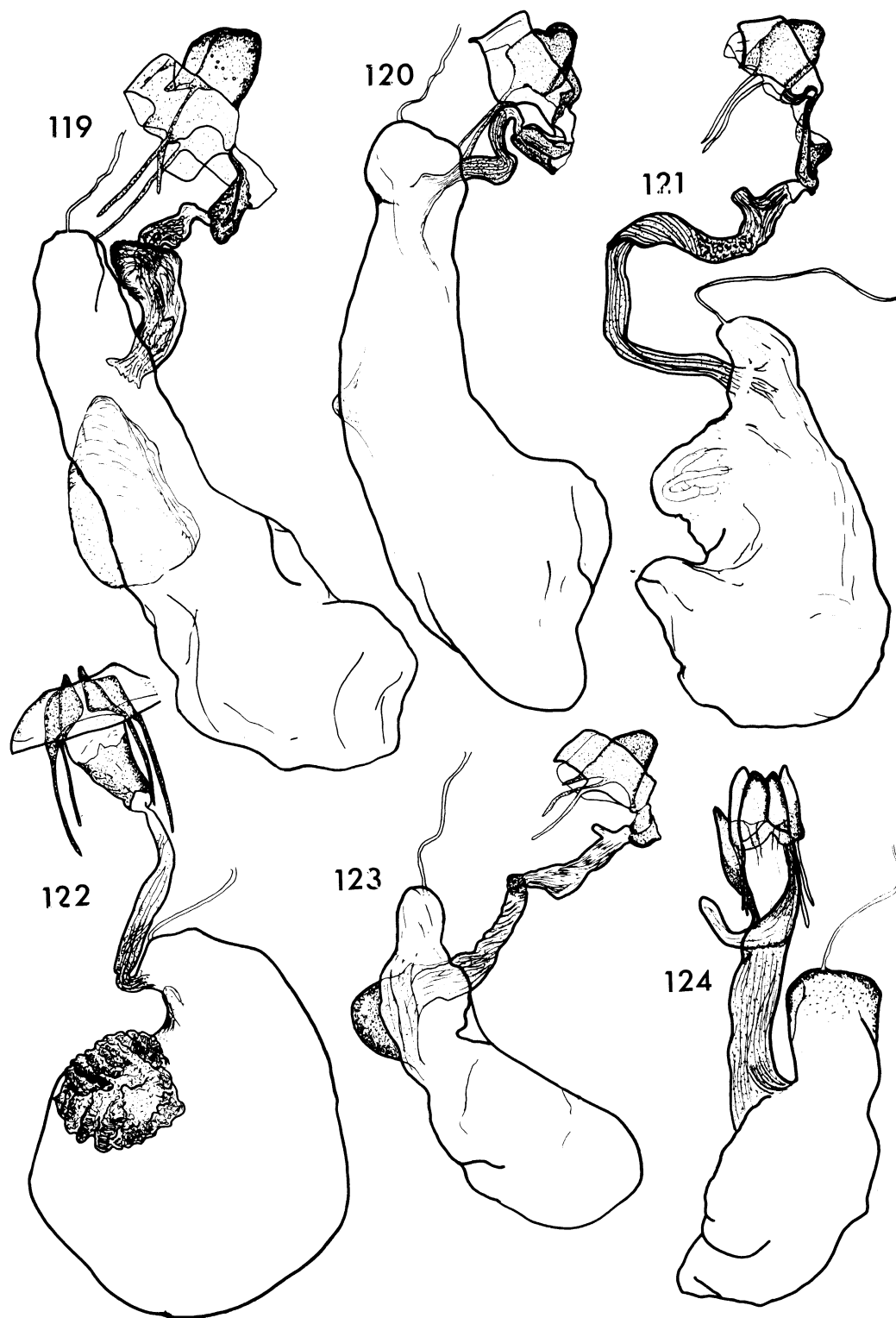
FIGURES 97-104.—Female genitalia (97, ventral view, 98-104, lateral view): 97, *Kachiptusia ou*; 98, *Allagrapha aerea*; 99, *Pseudoplusia includens*; 100, *Pseudeva palligera*; 101, *P. purpurigera*; 102, *Trichoplusia ni*; 103, *Eosphoropteryx thyatyroides*; 104, *Allagrapha aeroides*.



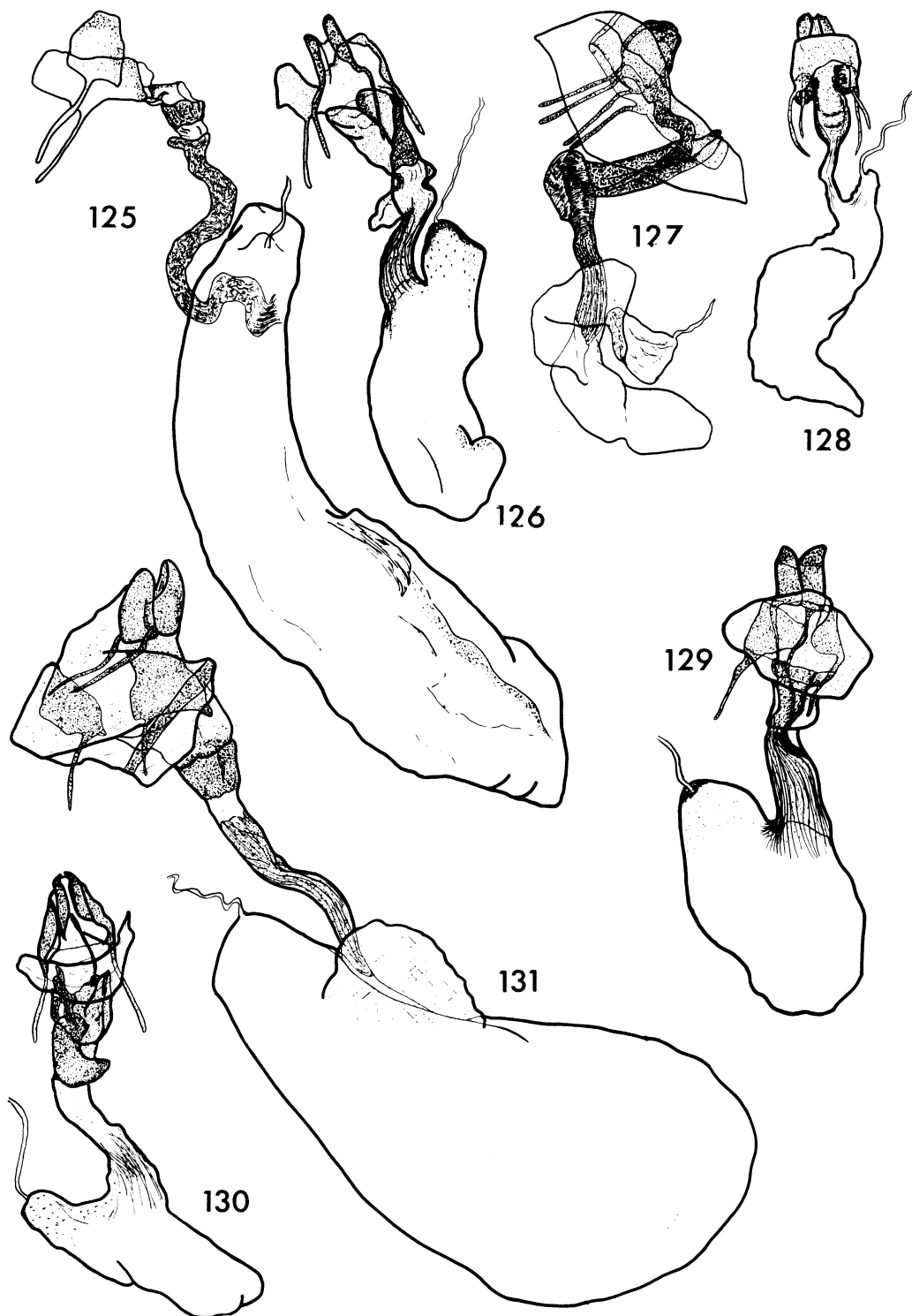
FIGURES 105–111.—Female genitalia: 105, *Trichoplusia oxygramma* (lateral view); 106, *Adeva albavitta* (lateral view); 107, *Autoplusia olivacea* (ventral view); 108, *Polychrysis morigera* (lateral view); 109, *Autoplusia egena* (ventral view); 110, *Polychrysis moneta* (lateral view); 111, *Chrysanympa formosa* (lateral view).



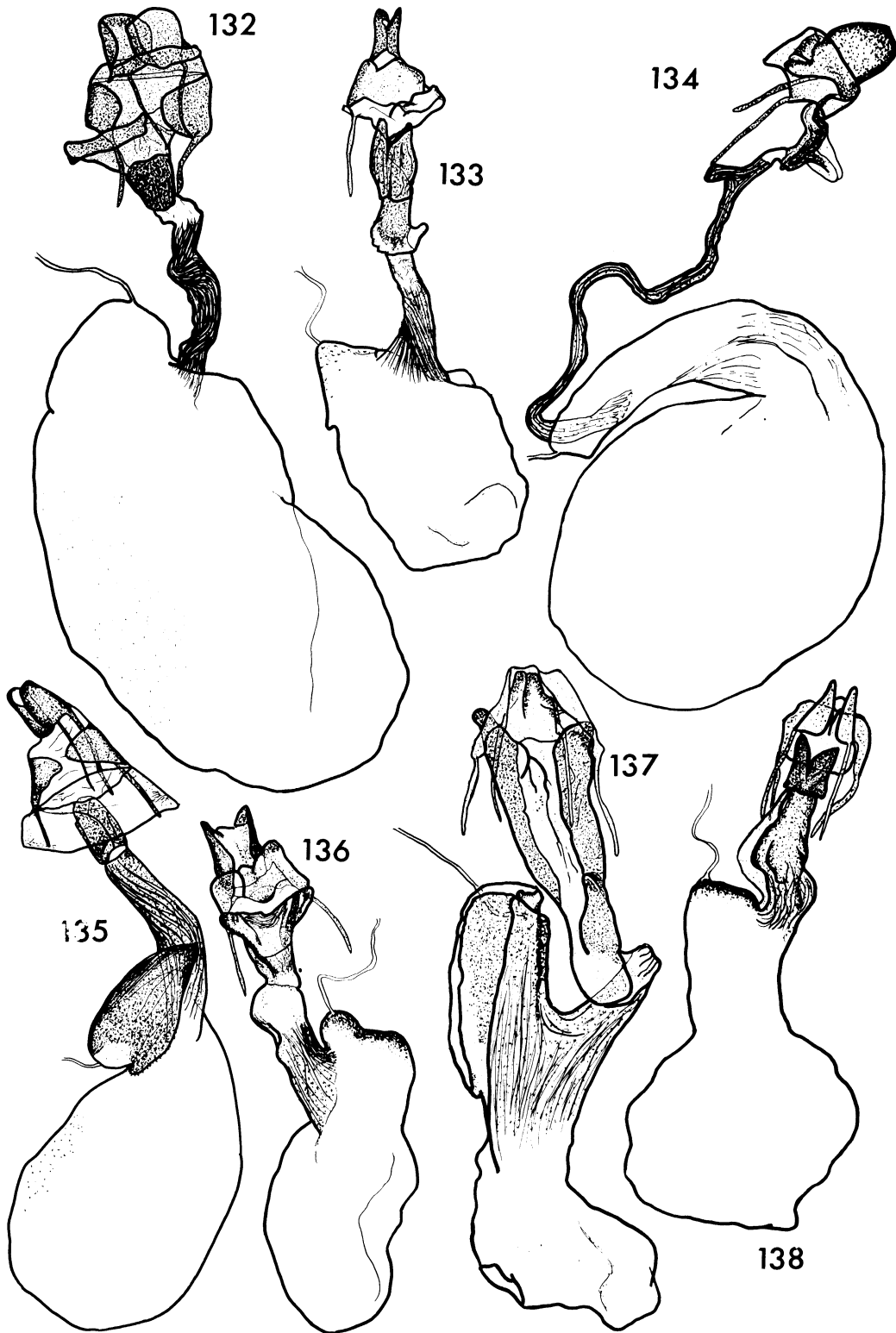
FIGURES 112-118.—Female genitalia (112-116, 118, lateral view; 117, dorsal view): 112, *Autographa precationis*; 113, *A. californica*; 114, *A. ampla*; 115, *A. biloba*; 116, *A. pseudogamma*; 117, *A. sansoni*; 118, *A. corusca*.



FIGURES 119-124.—Female genitalia: 119, *Autographa flagellum* (lateral view); 120, *A. mappa* (lateral view); 121, *A. labrosa* (lateral view); 122, *A. rubida* (dorsal view); 123, *A. pasiphaeia* (lateral view); 124, *Syngrapha celsa* (dorsal view).



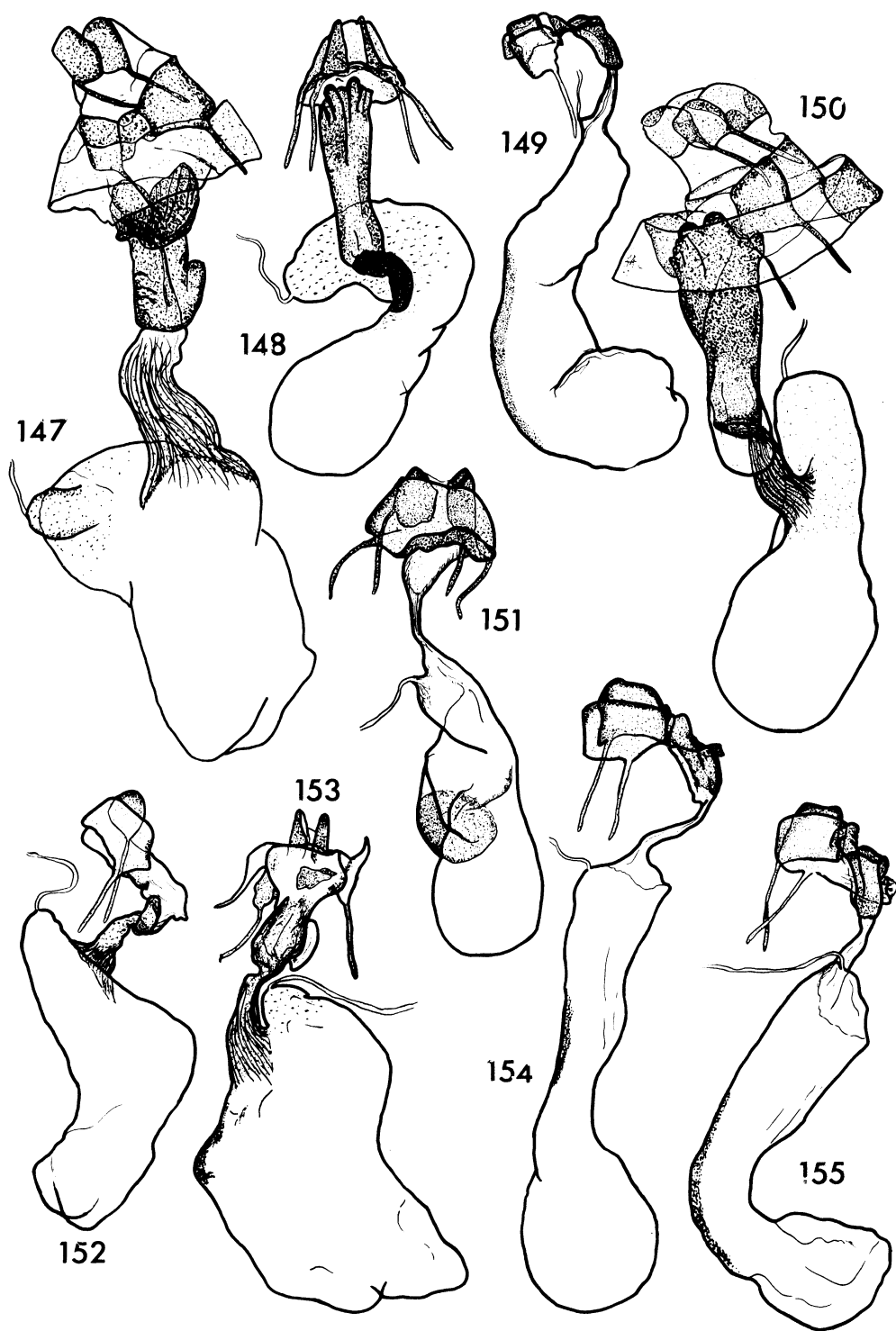
FIGURES 125-131.—Female genitalia: 125, *Autographa bimaculata* (lateral view); 126, *Syngrapha angulidens* (dorsal view); 127, *S. surena* (lateral view); 128, *S. alticola* (dorsal view); 129, *Syngrapha montana* (ventral view); 130, *S. alias* (ventral view); 131, *Autographa v-alba* (ventral view).



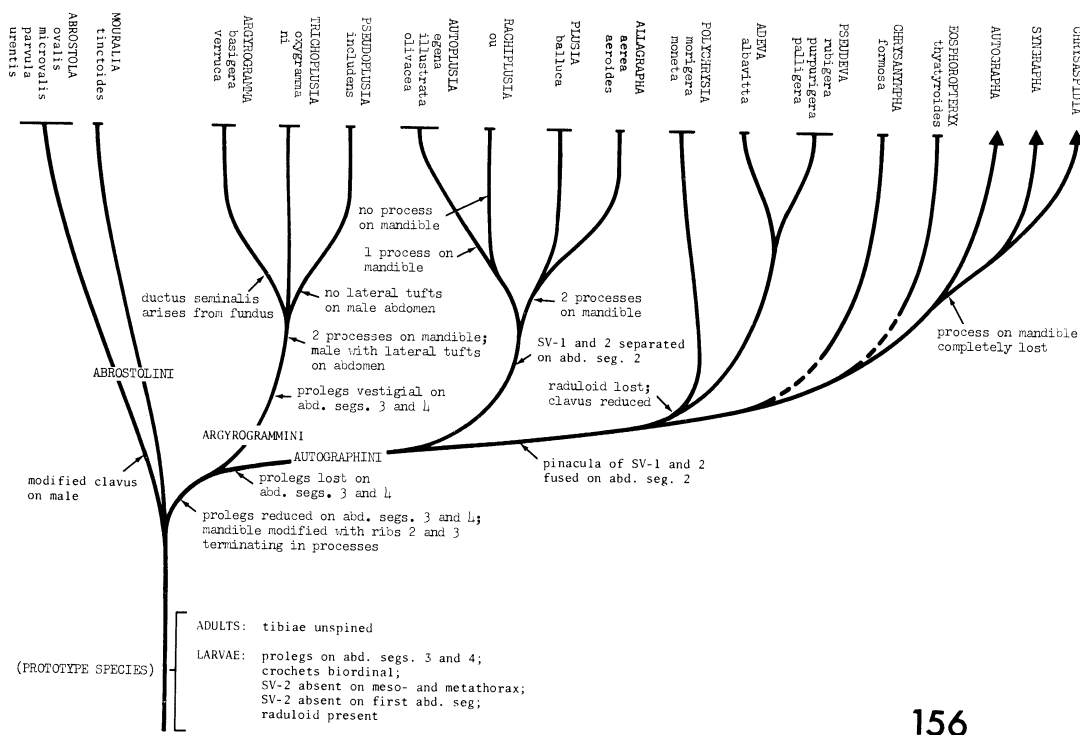
FIGURES 132-138.—Female genitalia: 132, *Autographa speciosa* (ventral view); 133, *Syngrapha rectangula* (ventral view); 134, *Autographa metallica* (lateral view); 135, *Syngrapha falcifera* (ventral view); 136, *S. sackeni* (ventral view); 137, *S. epigaea* (dorsal view); 138, *S. microgamma* (dorsal view).



FIGURES 139-146.—Female genitalia: 139, *Syngrapha orophila* (ventral view); 140, *S. snowi* (ventral view); 141, *S. octoscripta* (lateral view); 142, *S. selecta* (lateral view); 143, *S. viridisigma* (dorsal view); 144, *S. altera* (lateral view); 145, *S. abstrusa* (ventral view); 146, *S. ottolenguii* (ventral view).

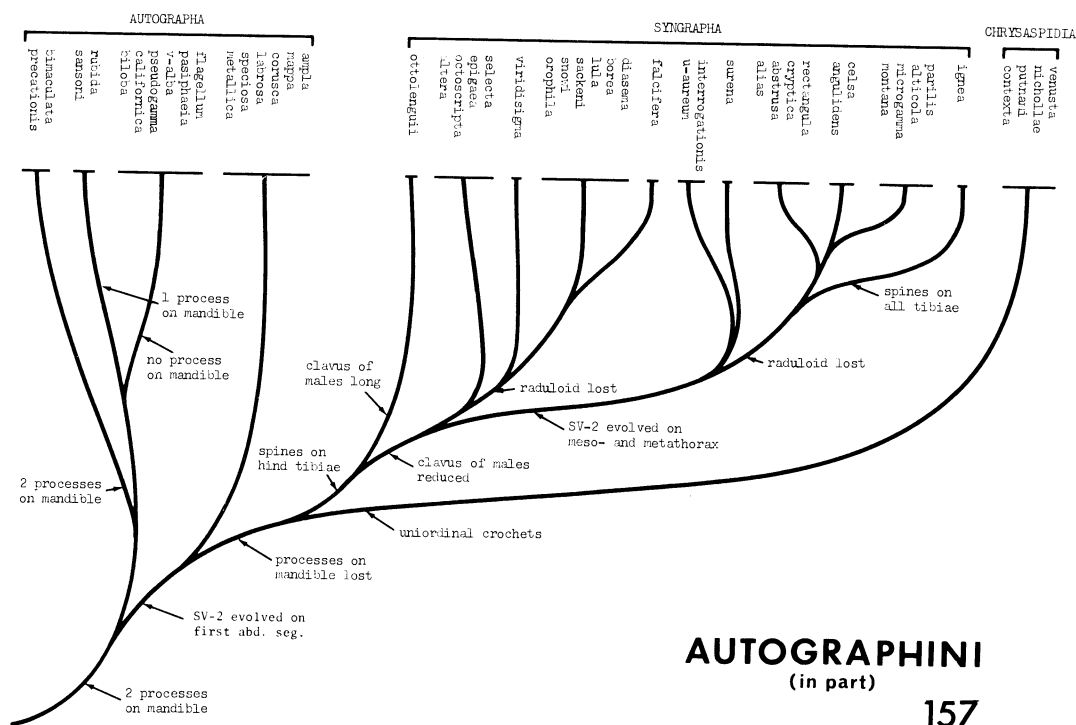


FIGURES 147–155.—Female genitalia: 147, *Syngrapha cryptica* (ventral view); 148, *S. u-aureum* (ventral view); 149, *Chrysaspidia putnami* (lateral view); 150, *Syngrapha interrogationis* (ventral view); 151, *Chrysaspidia nichollae* (dorsal view); 152, *S. parilis* (lateral view); 153, *S. lula* (ventral view); 154, *C. contexta* (lateral view); 155, *C. venusta* (lateral view).



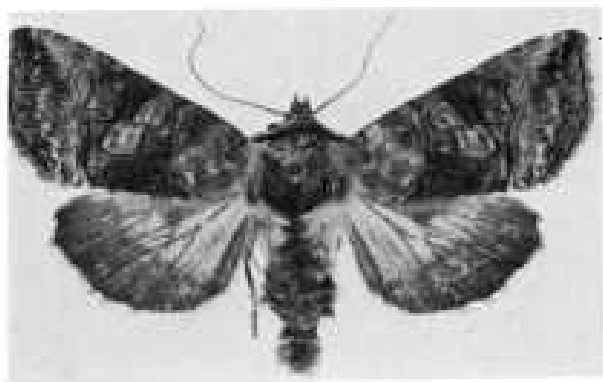
156

FIGURES 156.—Dendrogram (part I): Phylogeny of the subfamily Plusiinae less species of *Autographa*, *Syngrapha*, and *Chrysaspidia*.



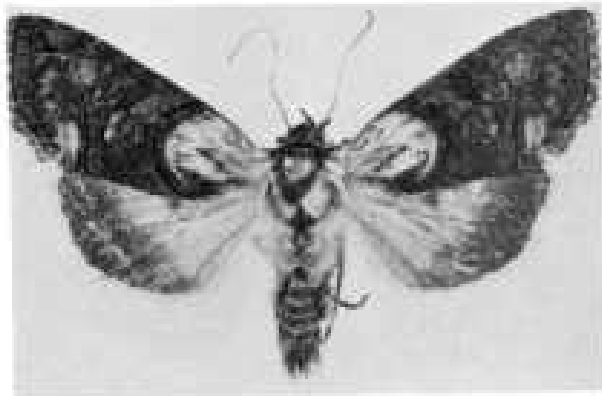
157

FIGURES 157.—Dendrogram (part II): Phylogeny of the species of *Autographa*, *Syngrapha*, and *Chrysaspidia*.



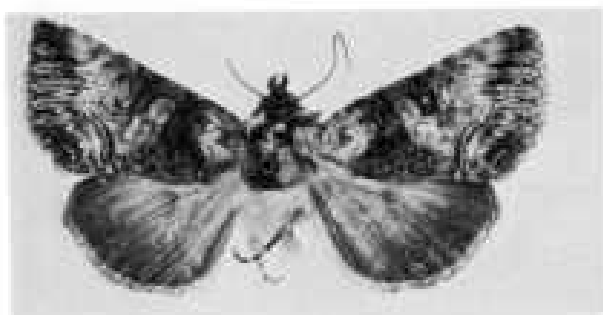
PN-5682

FIGURE 158.—*Abrostola urentis*.



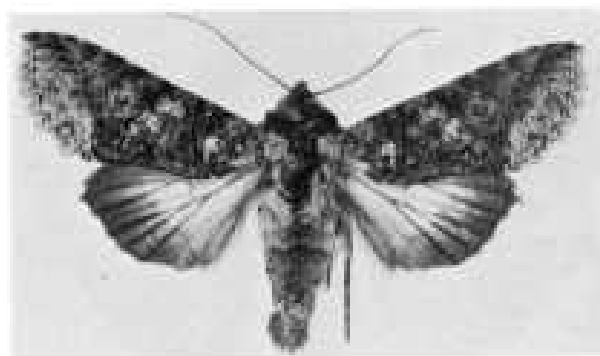
PN-5685

FIGURE 161.—*Abrostola ovalis*.



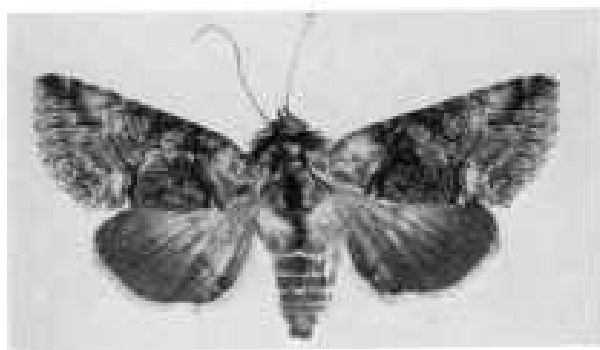
PN-5683

FIGURE 159.—*Abrostola parvula*.



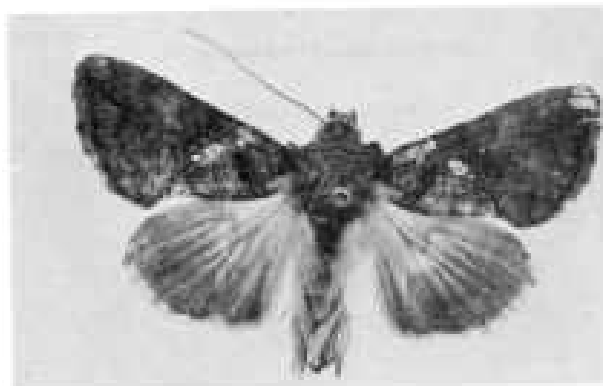
PN-5686

FIGURE 162.—*Mouralia tinctoides*.



PN-5684

FIGURE 160.—*Abrostola microvalis*.



PN-5687

FIGURE 163.—*Argyrogramma verruca*.

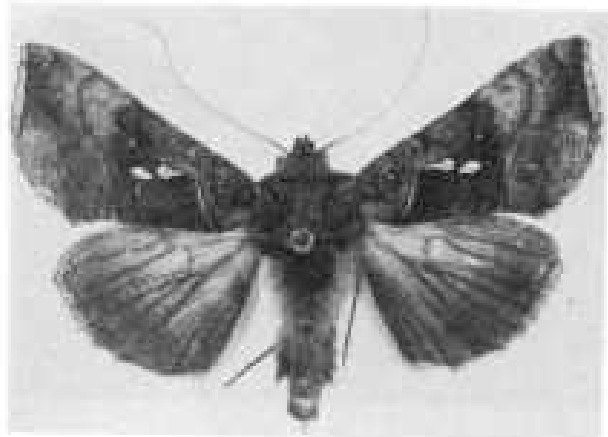


FIGURE 164.—*Argyrogromma basigera*. PN-5688

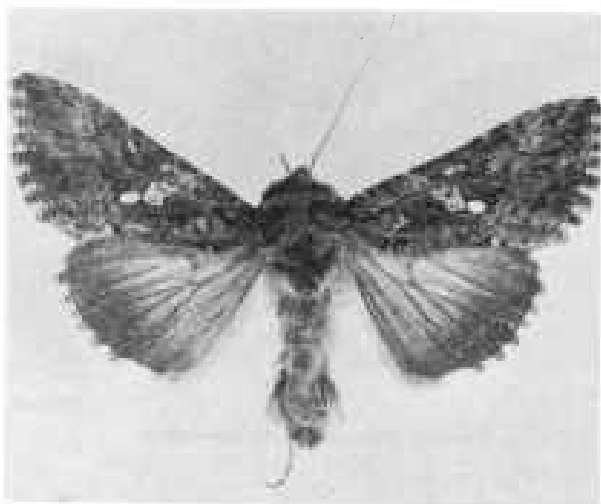


FIGURE 165.—*Trichoplusia ni*. PN-5689

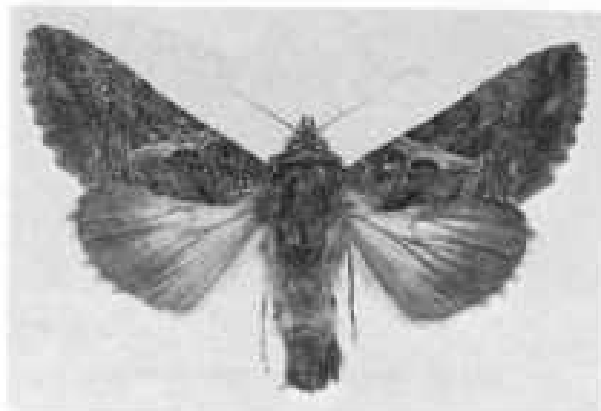


FIGURE 166.—*Trichoplusia oxygramma*. PN-5690

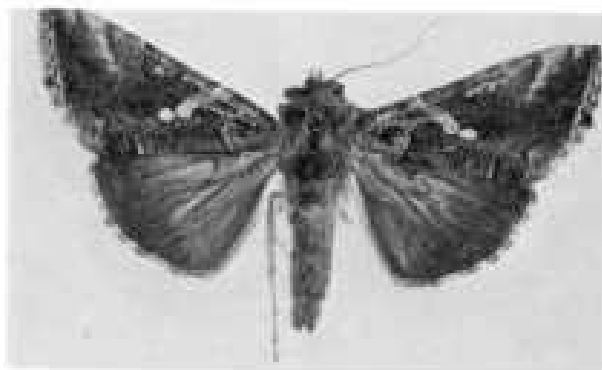


FIGURE 167.—*Pseudoplusia includens*. PN-5691

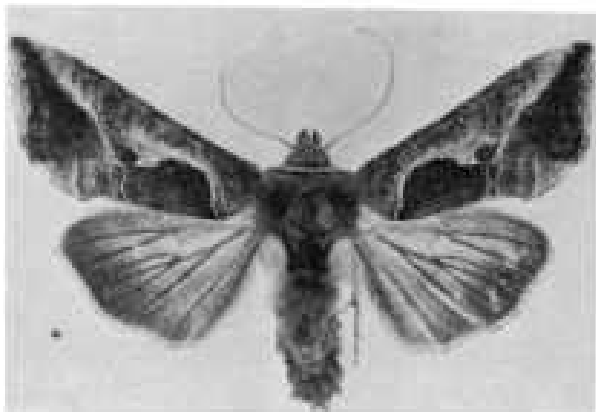


FIGURE 168.—*Autoplusia olivacea*. PN-5692

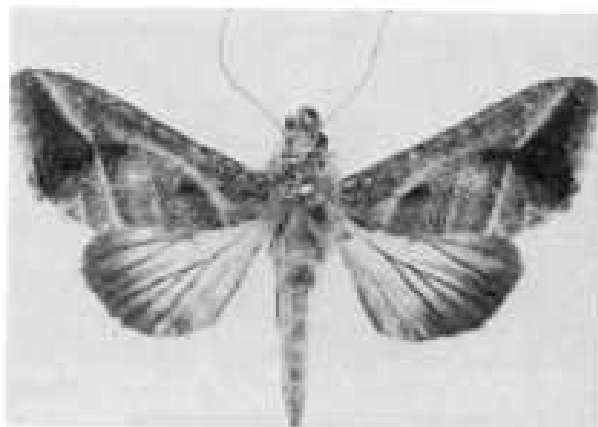


FIGURE 169.—*Autoplusia illustrata*. PN-5693

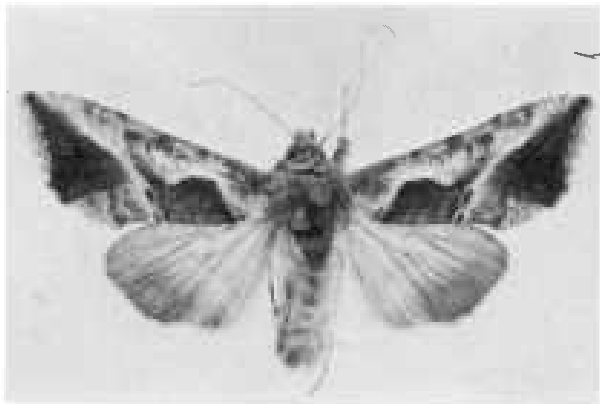


FIGURE 170.—*Autoplusia egena*.

PN-5694

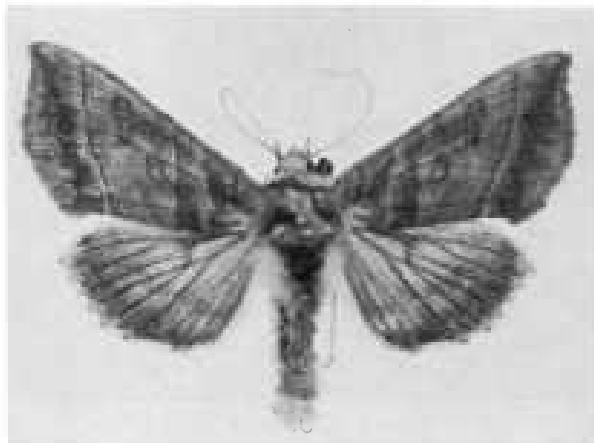


FIGURE 173.—*Allagrapha aeroides*.

PN-5697

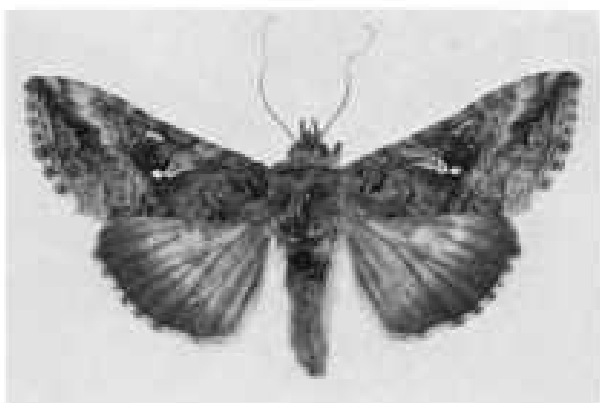


FIGURE 171.—*Rachiplusia ou*.

PN-5695

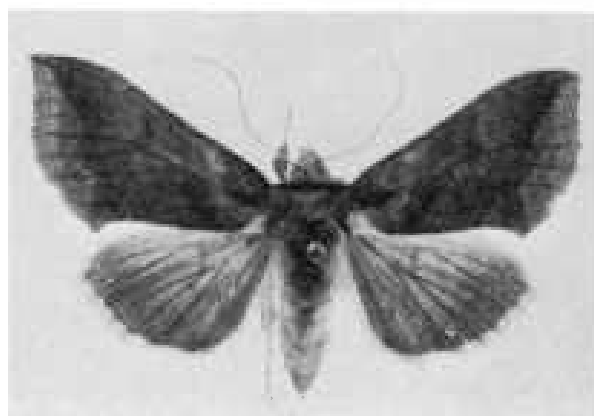


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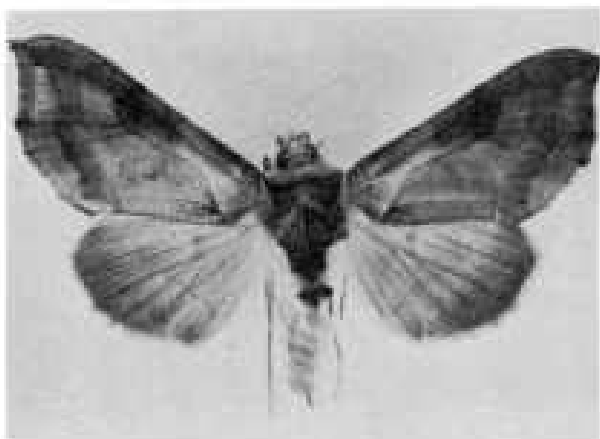


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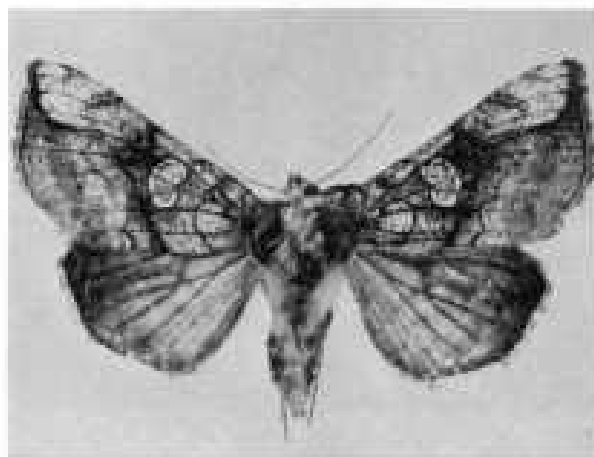
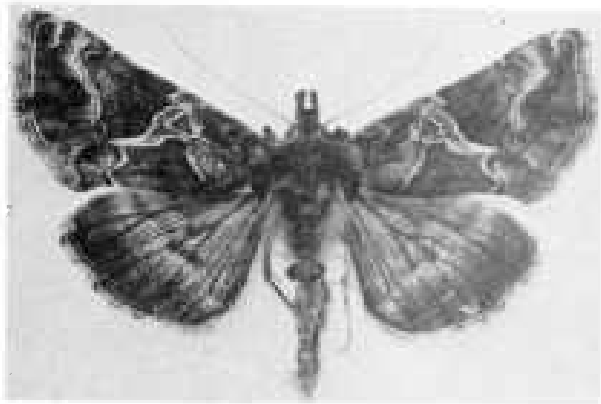
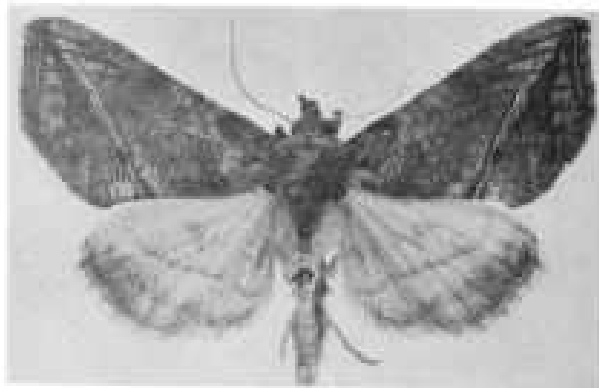


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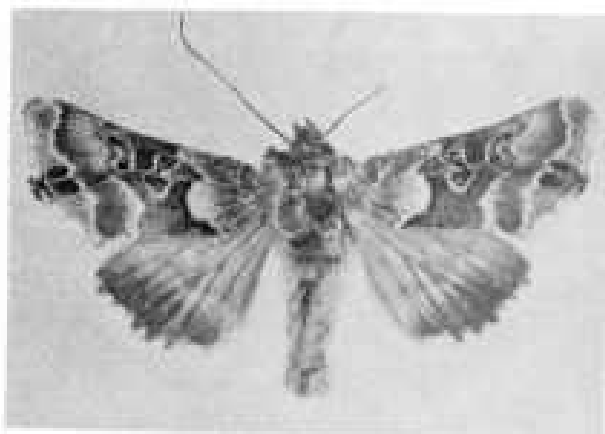
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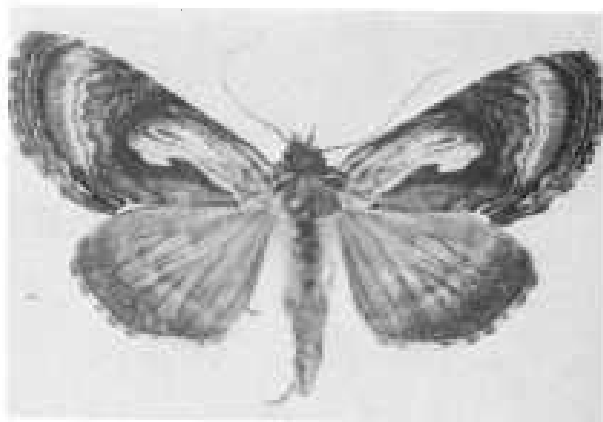
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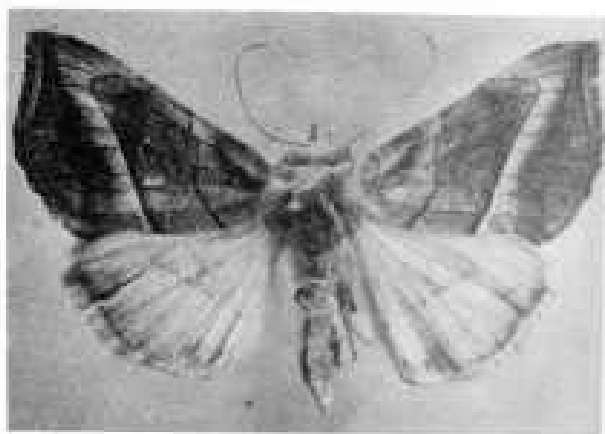
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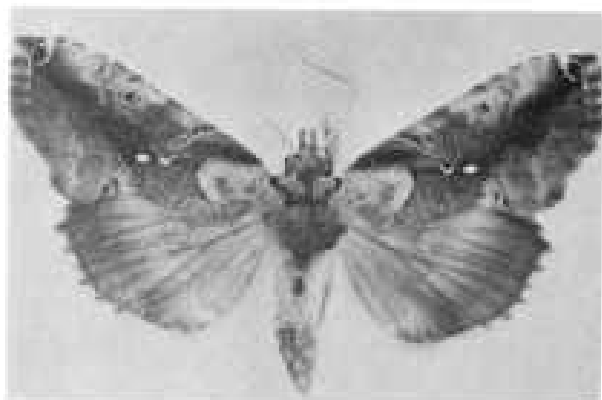
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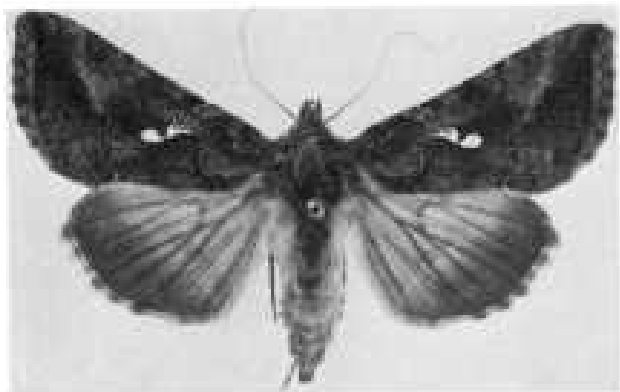


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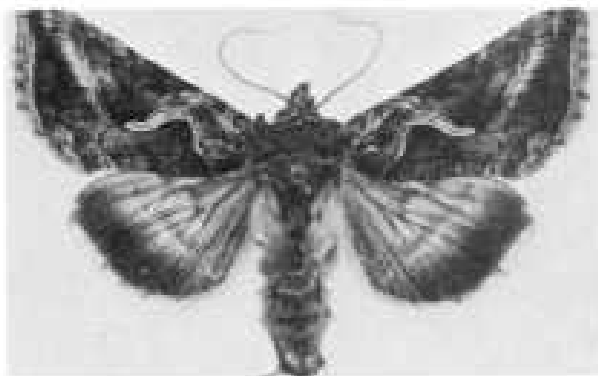


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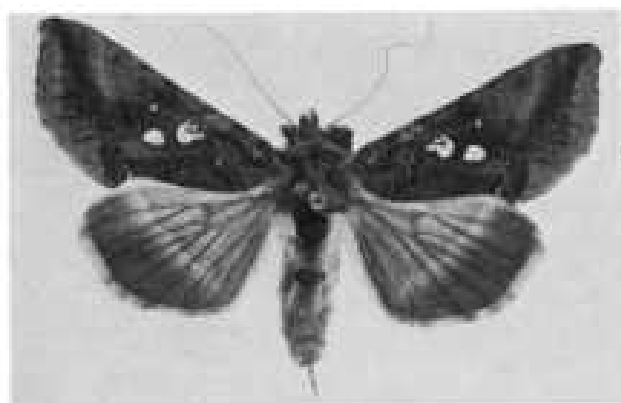


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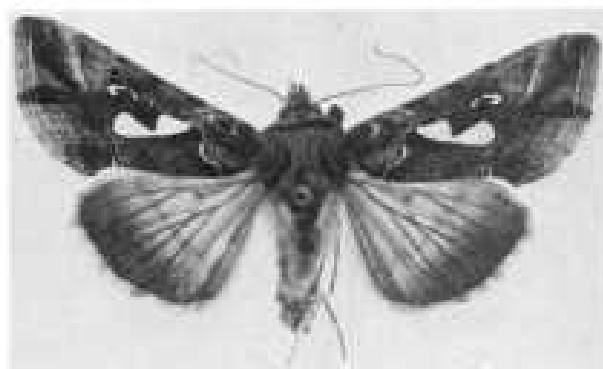


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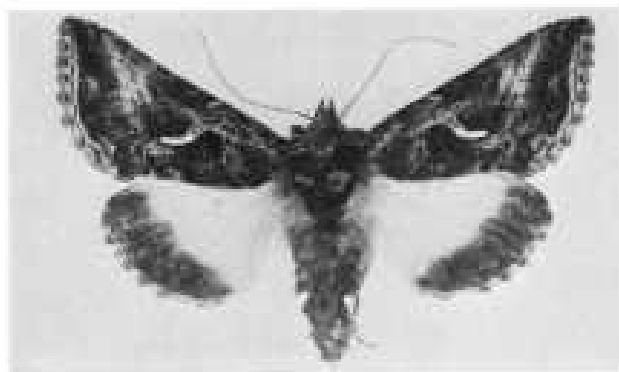


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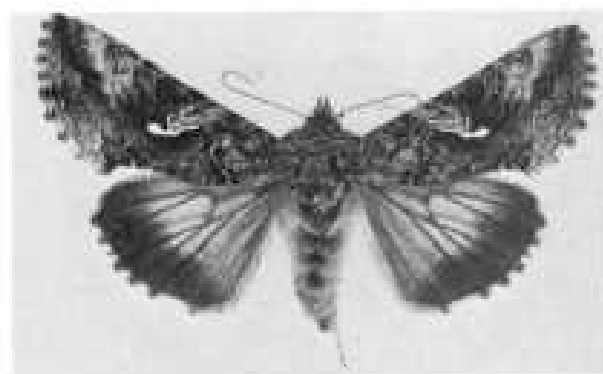


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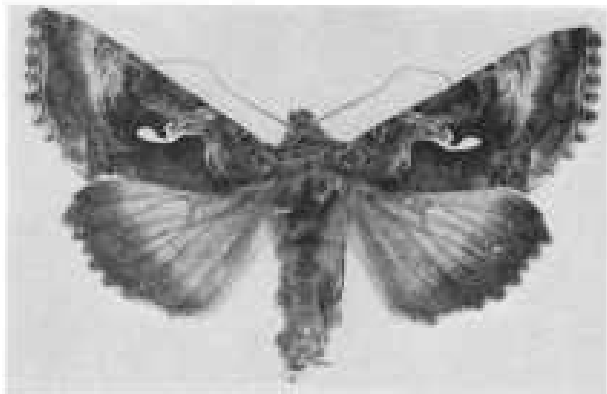


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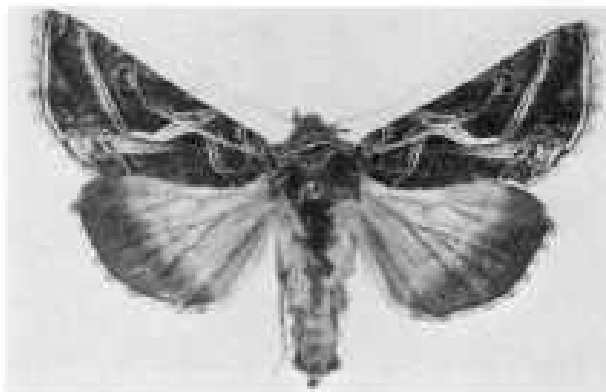


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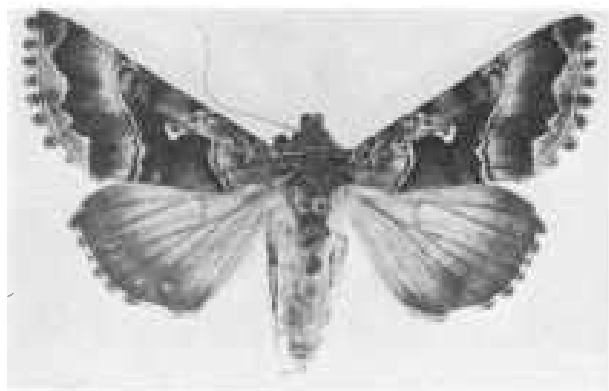


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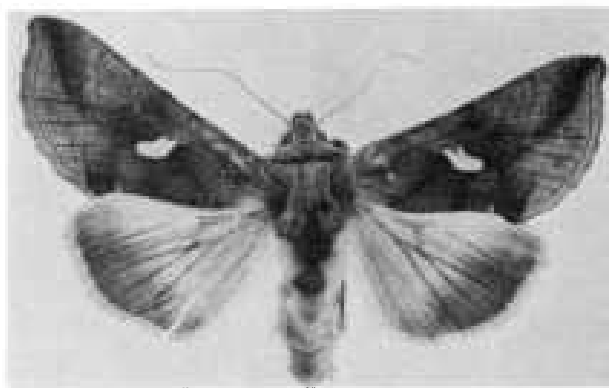


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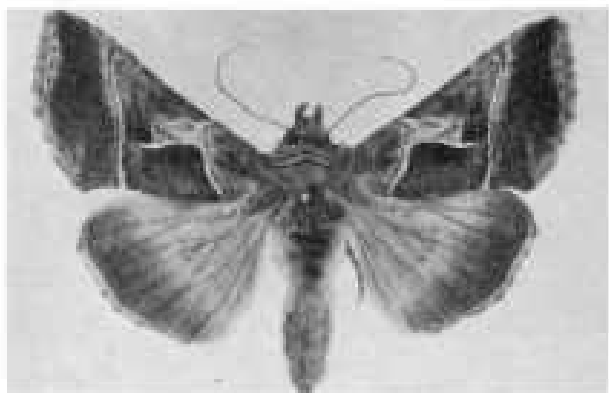


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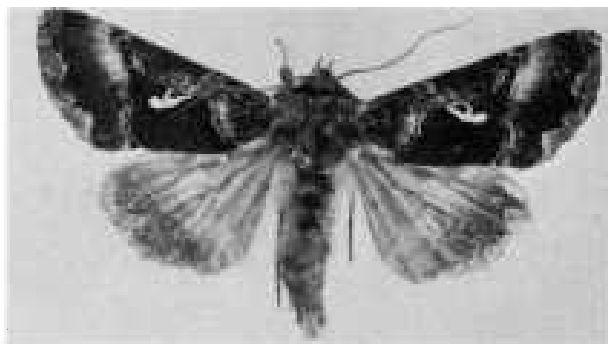


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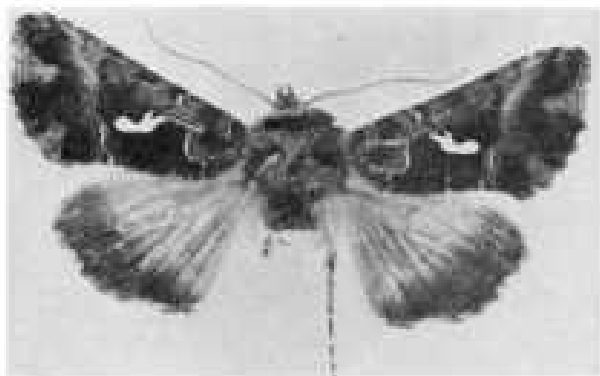


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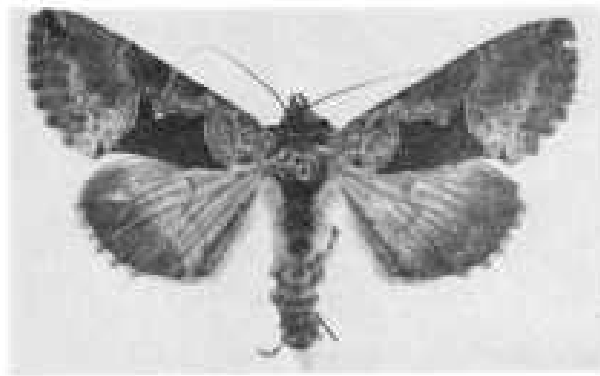


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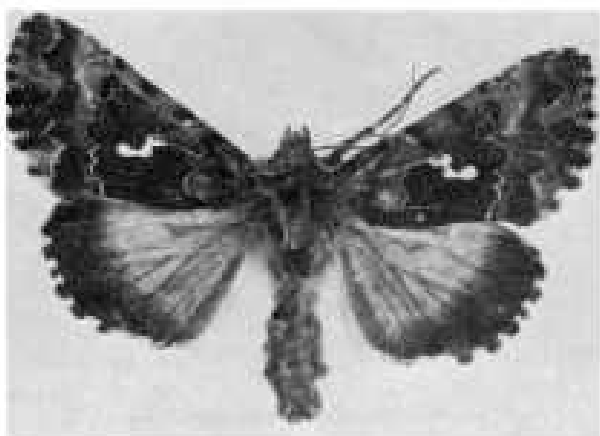


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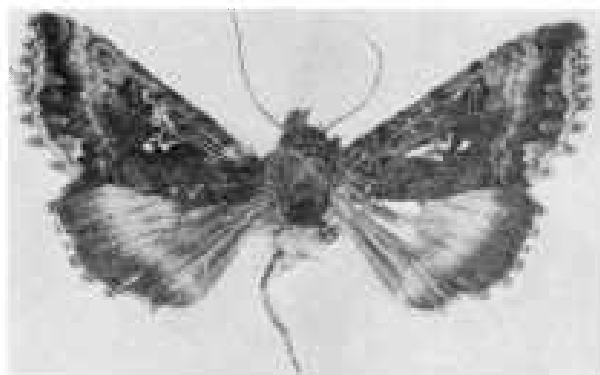


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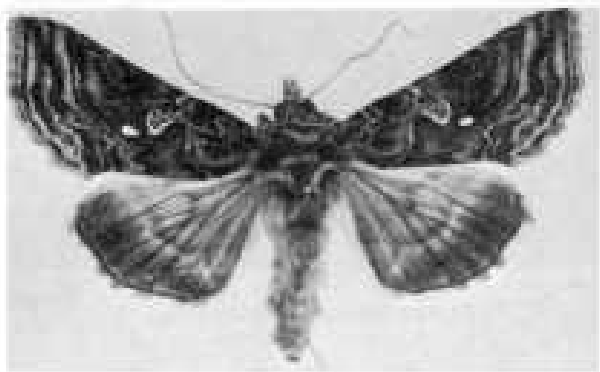


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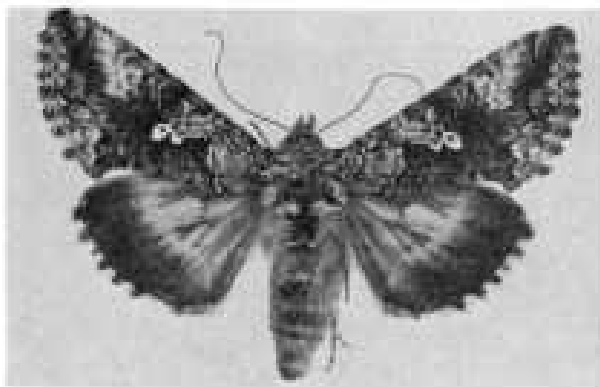


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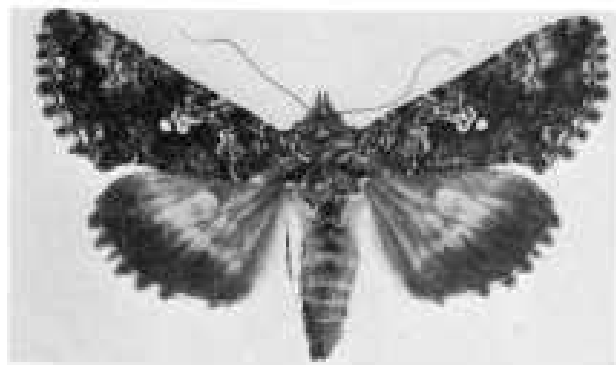


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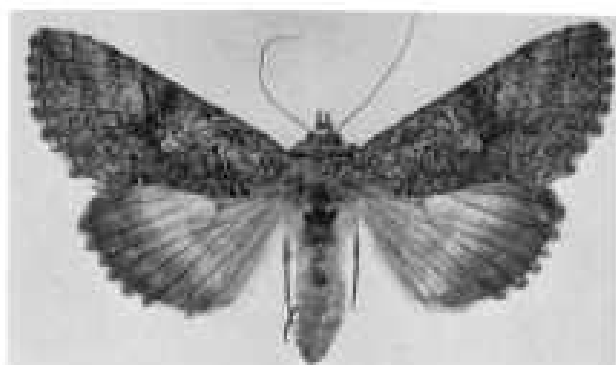


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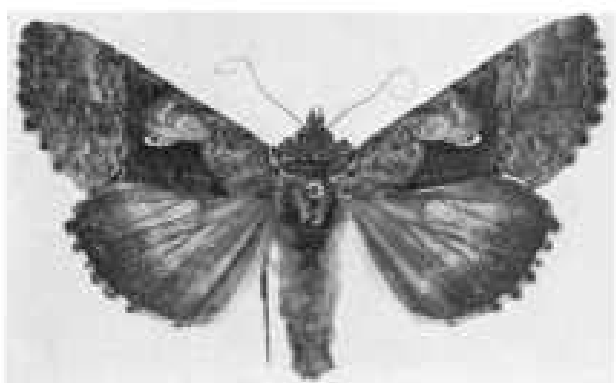


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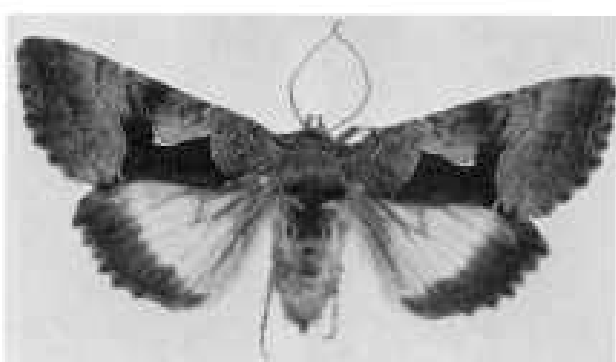


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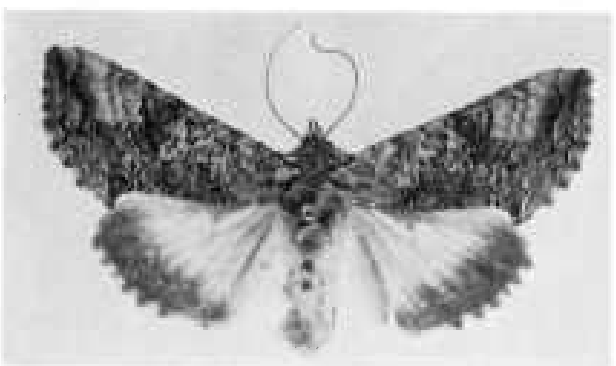


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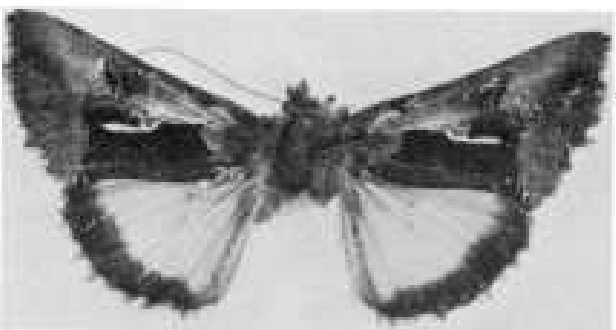


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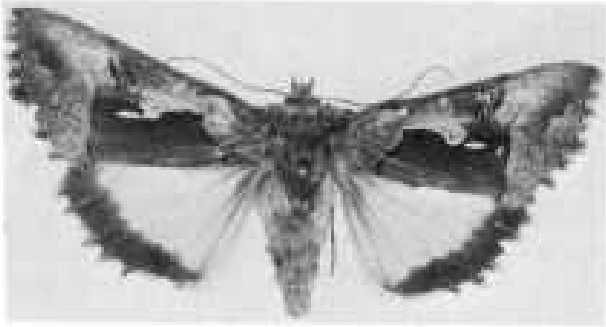


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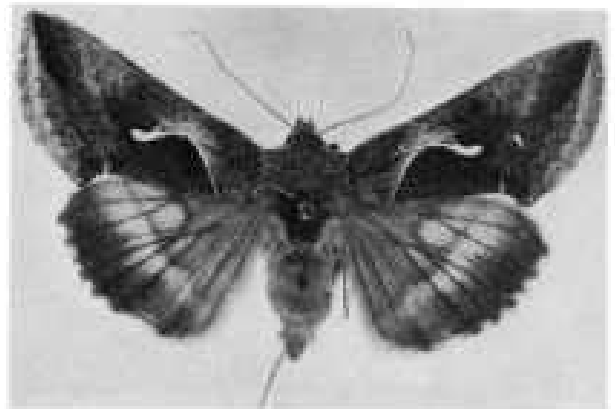


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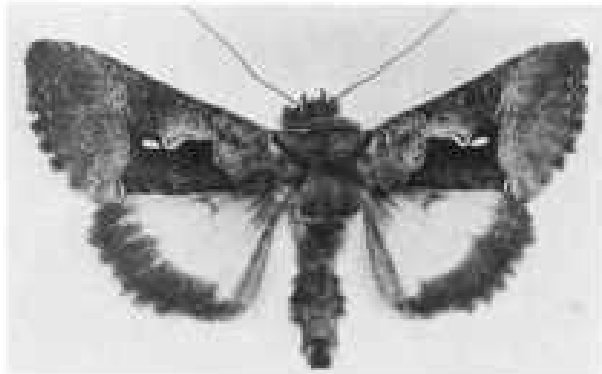


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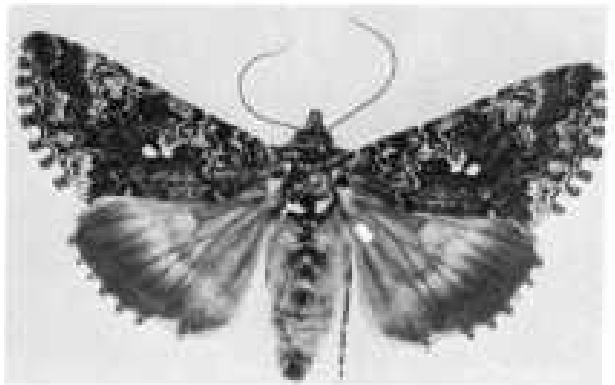


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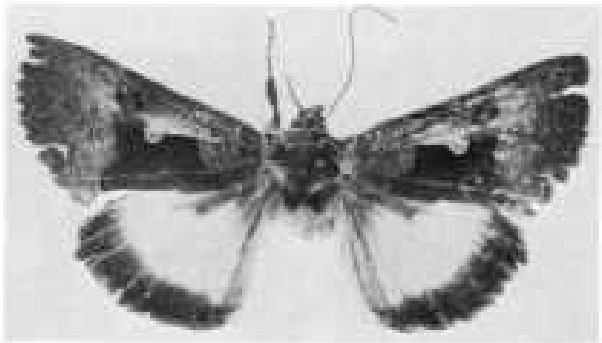


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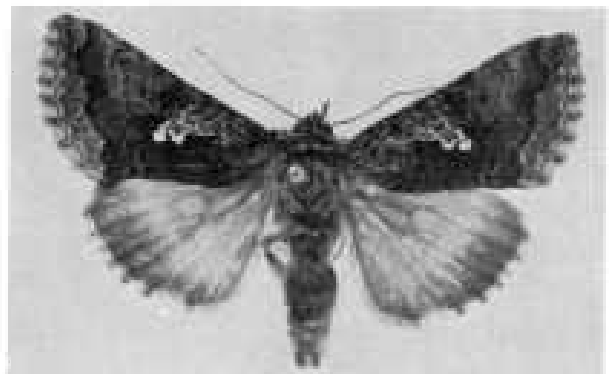
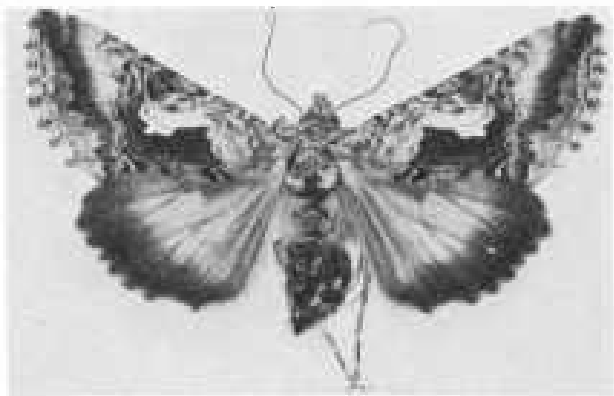
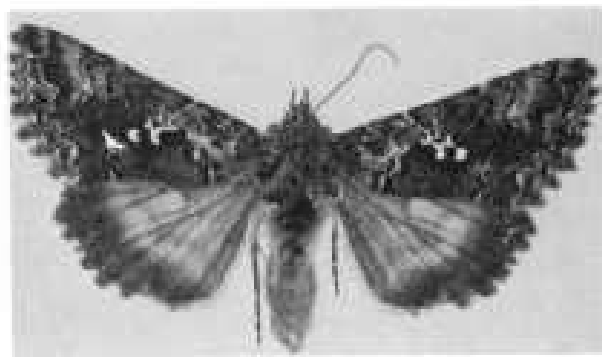


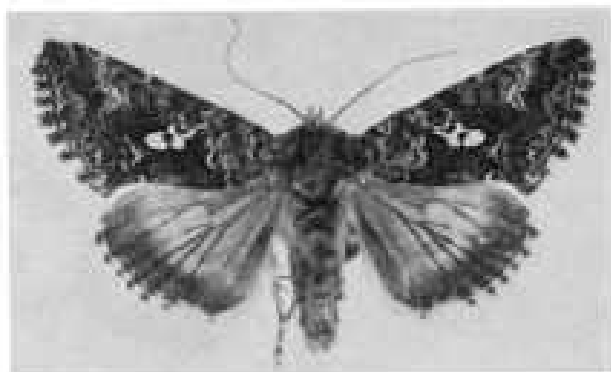
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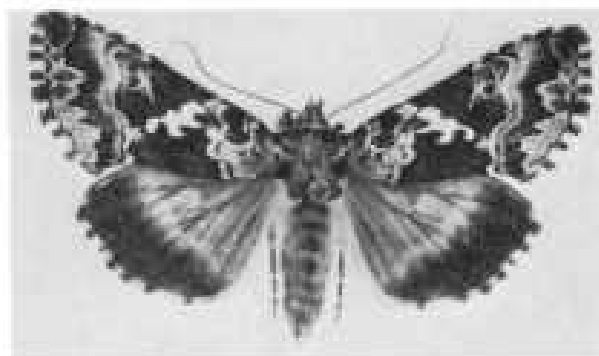
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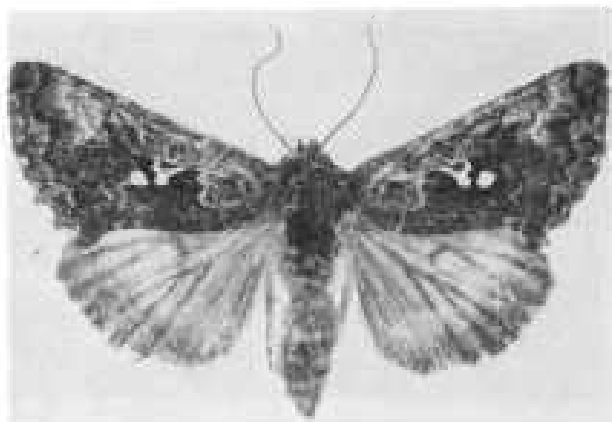
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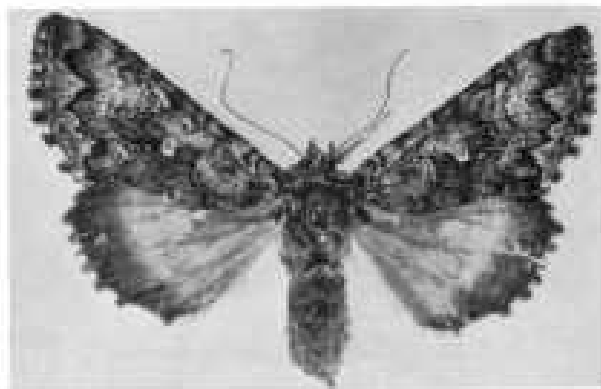
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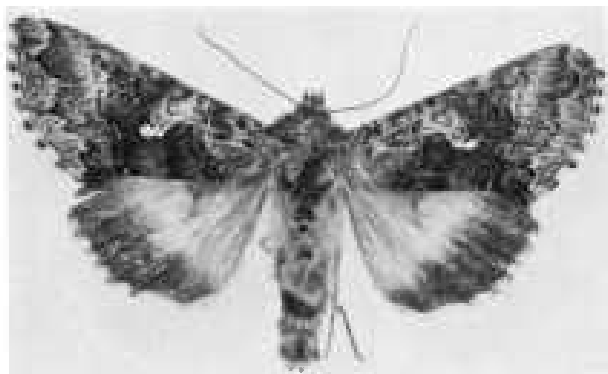


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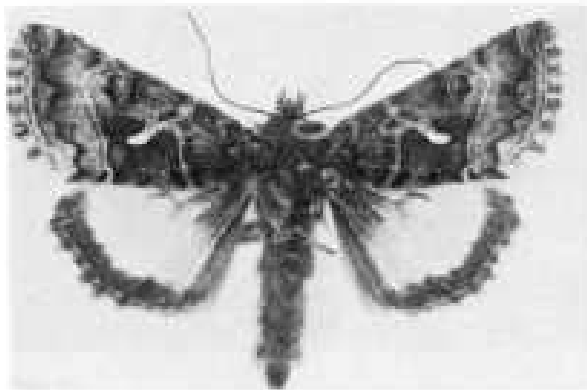


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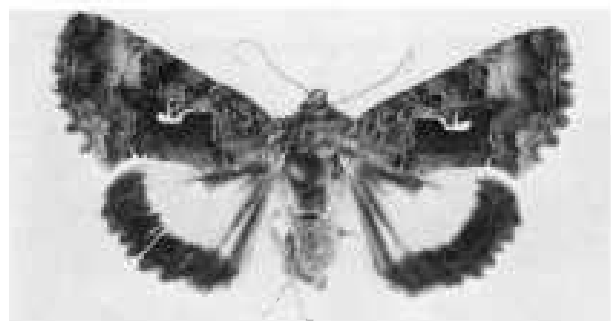


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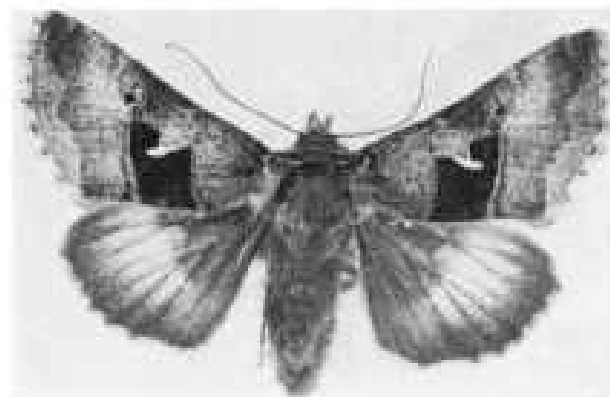


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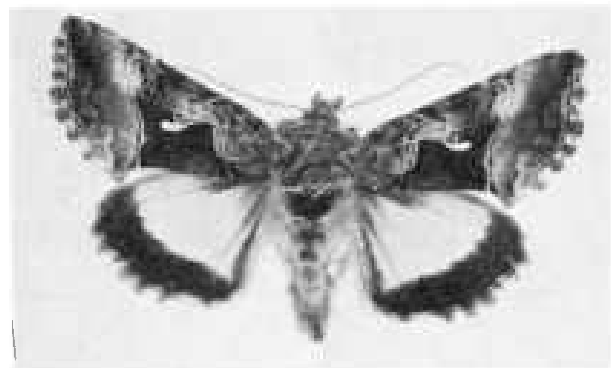


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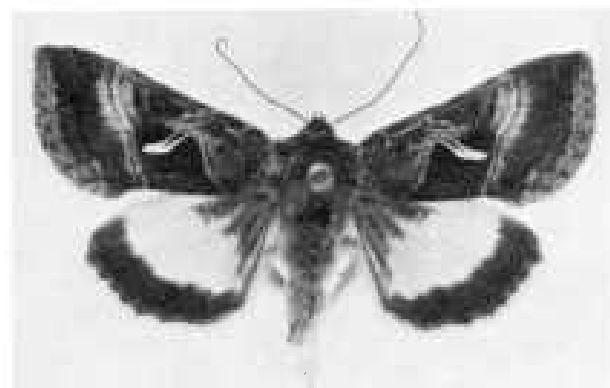


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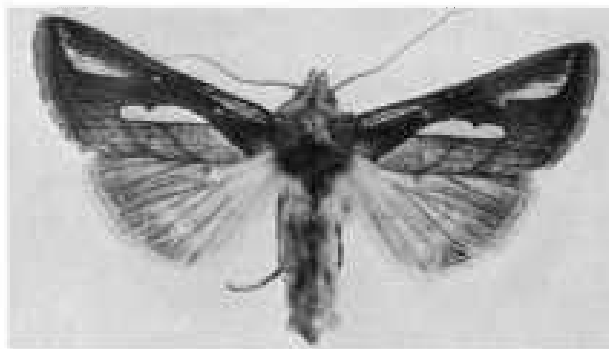


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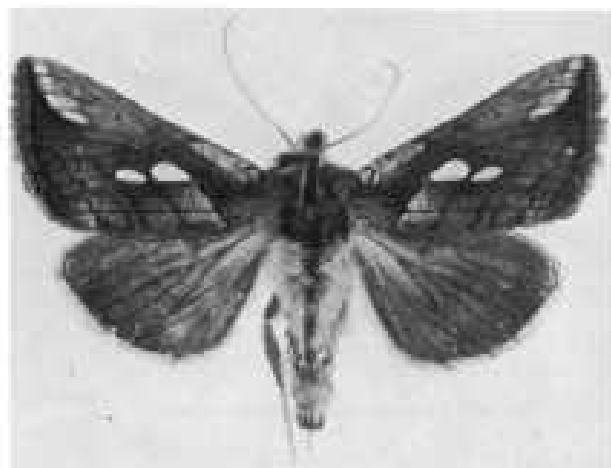


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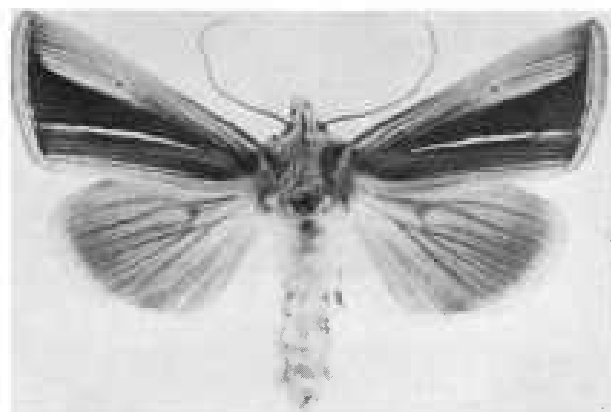


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